

Utah Department of Transportation



**Supplemental Specifications
for**

**2005 Standard
Specifications**

**FOR ROAD AND BRIDGE
CONSTRUCTION**

U.S. Standard Units (Inch-Pound Units)

Issued March 8, 2007

Memorandum

UTAH DEPARTMENT OF TRANSPORTATION

DATE: March 8, 2007

TO: Holders of Hard Copy of Standard Specifications

FROM: Barry Axelrod, CDT
Standards and Specifications

SUBJECT: Supplemental Specifications Distribution, dated March 8, 2007

Applicable files for the change are attached. Maintain these files as a supplemental update to the UDOT Standard Specifications dated January 1, 2005. No pages are to be removed or replaced in the basic book, electronic or hard copy.

If you are in need of electronic copies of any Standard or Supplemental Specification please refer to the Standards and Specifications Web site at <http://www.udot.utah.gov/index.php?m=c&tid=302>. From there select the **2005 Standards** subtopic.

Please note that the 2005 Standards are still in effect. The next version of the Standards is planned for 2008.

If you have any questions or problems with the electronic files contact me at 801-964-4570 or by email at baxelrod@utah.gov.

Attachments

Listing of Supplemental Specifications

Issue Date: March 14, 2005

Revised February 24, 2005

Section 01282M Article 1.1 Paragraph D added and Article 1.14 Paragraph E replaced.

Section 01284 New section added

Section 02785M Replaces Table 1 to correct reference callout from AASHTO to ASTM

Section 02843 Entire section revised.

Section 06055M Article 1.2 Paragraph F added and Article 2.2 Paragraphs A and D modified.

Issue Date: May 10, 2005

Revised April 28, 2005

Section 02827 New section added

Issue Date: July 12, 2005

Revised June 30, 2005

Section 02745 Entire section revised.

Section 03412M Article 1.3 revised, Article 1.4 Paragraph E added, Article 1.5 Paragraph C added, and Article 3.7 added.

Section 05120 M Article 1.3 revised, Article 1.4 Paragraph D added, and Article 3.5 added.

Issue Date: September 12, 2005

Revised August 25, 2005

Section 01452M Article 3.1 Paragraph B item 1 replaced.

Section 01571 Entire section replaced.

Section 01574M Article 1.1 replaced, Article 1.3 Paragraph B added, and Article 3.1 Paragraphs F and G added.

Section 01721M Article 1.2 replaced.

Section 02842M Article 1.3 Paragraph C and Article 2.1 Paragraph A replaced.

Section 13551M Article 1.3 replaced, Article 2.1 replaced, Article 3.3 Paragraph C replaced, Article 3.5 Paragraph C replaced, and Article 3.5 Paragraph D added.

Section 13552M Article 1.1 Paragraph A replaced, Article 1.3 replaced, Article 2.2 through Article 2.6 replaced, Article 2.8, Paragraph C added, and Article 3.2 replaced.

Section 13553M Article 1.2 paragraphs I and J replaced, Article 1.3 replaced, Article 2.1 Paragraphs H and I replaced, Article 3.1 Paragraph F replaced, Article 3.1 Paragraph Q3 replaced, Article 3.2 Paragraph A replaced, Article 3.3 Paragraph F replaced, Article 3.4 Paragraph C added, and Article 3.5 Paragraph C added.
Section 13554M Article 2.2 replaced and Article 3.1 Paragraph N through H replaced.
Section 13555M Article 1.3 Paragraph E added, Article 2.1 Paragraph A replaced, Article 3.1 Paragraph D deleted, Article 3.2 Paragraphs C, G, and H replaced, Article 3.4 replaced, and Article 3.6 Paragraphs A and B replaced.
Section 13556 Entire section revised.
Section 13561M Article 2.1 Paragraph K added, Articles 3.1 Paragraphs E through G replaced, and Article 3.2 Paragraph A replaced.
Section 13594M Article 2.3 Paragraph A replaced, Article 2.3 Paragraph C replaced, Article 2.4 replaced.

Issue Date: November 9, 2005

Revised October 27, 2005

Section 00725M Article 1.2, paragraph B added, Article 1.4 replaced.
Section 02745 Entire section originally revised July 12, 2005. This change corrected error in Table 13, Float Test.

Issue Date: March 2, 2006

Revised February 23, 2006

Section 00555M Article 1.6, paragraph A replaced.
Section 00725M Article 1.2, paragraph B added, Article 1.4 replaced, Article 1.18 Paragraph C1 added, article 1.18 Paragraph D replaced, and Article 1.18 Paragraphs E – I replaced. **(Replaces Supplemental Specification 00725M issued November 9, 2005.)**
Section 00820M Article 1.2 replaced, Article 1.15 replaced, and Article 1.16 replaced.
Section 01280M Article 1.3 replaced and Article 1.10 deleted.
Section 01574M Article 1.1 replaced, Article 1.3 Paragraph B added, Article 1.4, paragraph B1 added, Article 3.1 Paragraphs F and G added, and Article 3.4, paragraph A replaced. **(Replaces Supplemental Specification 01574M issued September 12, 2005.)**
Section 01721M Article 1.1, Paragraph A replaced, Article 1.2 replaced, Article 1.5, Paragraph F and G replaced, Article 3.3, Paragraph C deleted, and Article 3.11 replaced. **(Replaces Supplemental Specification 01721M issued September 12, 2005.)**
Section 02317 Entire section revised.
Section 02748M Article 2.1, Paragraph A replaced, Article 2.2, Paragraph A replaced, and Article 3.2 replaced.

Issue Date: May 2, 2006

Revised April 27, 2006

Section 02633 New section added.

Section 13557 Entire section revised. Title changed.

Issue Date: July 11, 2006

Revised June 29, 2006

Section 01452M Article 1.5, paragraph B replaced, Article 3.1 Paragraph B item 1 replaced, and Table 1 replaced.

Section 01455 Entire section revised.

Section 01561 Deleted by change to Section 01571.

Section 01571 Entire section revised. Deleted Sections 01561 and 01574.

Section 01574 Deleted by change to Section 01571.

Section 02610 Entire section revised.

Section 02645 Entire section revised. Title changed.

Section 02896M Article 3.1, paragraph A replaced, Article 3.3, paragraph C7 added, and Article 3.3, paragraph E replaced.

Issue Date: September 11, 2006

Revised August 31, 2006

Section 02373M Article 1.3, Paragraph C deleted and Article 2.1 replaced.

Section 02613 Entire section revised.

Section 02741M Table 6 replaced.

Section 02785 Entire section revised. Replaced Supplemental Specification 02785M.

Section 02969 Entire section revised.

Section 03311M Table 1 replaced.

Section 03412M Article 3.2, Paragraph E replaced. Previously issued Supplemental Specification incorporated.

Issue Date: December 18, 2006

Revised November 30, 2006

Section 00555 Entire section revised. Replaced Supplemental Specification 00555M.

Section 00570 Entire section revised.

Section 00725 Entire section revised. Replaced Supplemental Specification 00725M.

Section 00727 Entire section revised.

Section 01282 Entire section revised. Replaced Supplemental Specification 01282M.

Section 01284 Replaces previously issued Supplemental Specification that added Section 01284. Article 1.2, Paragraph B modified and Paragraph D deleted.

Section 01561 Section deleted per Supplemental Specification 01571 issued July 11, 2006. Delayed issue, Supplemental for Section 01561 not previously issued.

Section 01574 Section deleted per Supplemental Specification 01571 issued July 11, 2006. Delayed issue, Supplemental for Section 01574 not previously issued.

Section 02056 Entire section revised. Name of section changed and Sections 02061, 02324, and 02330 deleted.

Section 02061 Section deleted per Supplemental Specification 02056.

Section 02324 Section deleted per Supplemental Specification 02056.

Section 02330 Section deleted per Supplemental Specification 02056.

Section 02844 Entire section revised.

Issue Date: March 8, 2007

Revised February 22, 2007

Section 01284 Replaces previously issued Supplemental Specification that added Section 01284 and one that modified Article 1.2, Paragraph B and deleted Paragraph D. Latest change Article 1.4, Paragraph A replaced.

Section 02754 Entire section revised.

Section 02765 Entire section revised.

Section 02843 Entire section revised.

Section 02892 Entire section revised.

Section 13551 Entire section revised. Replaced Supplemental Specification 13551M.

Section 13552M Articles 1.1, Paragraph A, 1.3, 1.4, 2.2 - 2.6, 3.1, Paragraph A, C, and F, 3.2, 3.4 Paragraph C, 3.8, Paragraphs B - E, 3.9, Paragraphs B and C, and 3.11, Paragraph B replaced. Article 2.7, Paragraph B deleted, and Article 2.8, Paragraph C added.

Section 13553 Entire section revised. Replaced Supplemental Specification 13553M.

Section 13554 Entire section revised. Replaced Supplemental Specification 13554M.

Section 13555M Articles 1.2, 1.3, Paragraph E, 2.1, Paragraph A, 2.2, Paragraph B, 2.7, 3.1, Paragraph C, 3.2, 3.3, Paragraph E, 3.4, and 3.6, Paragraphs A and B replaced. Article 2.4, Paragraph B and 3.3, Paragraph F added. Article 3.1, Paragraph D deleted.

Section 13561 Entire section revised. Replaced Supplemental Specification 13561M.

Section 13591M Articles 3.1, Paragraph A, 3.2, Paragraphs D, E, and G, 3.3, Paragraphs A, E, F, I, and J, and 3.4, Paragraphs A and B replaced. Articles 1.3, Paragraph B and 3.3, Paragraph L deleted.

Section 13592 Entire section revised.

Section 13594 Entire section revised. Replaced Supplemental Specification 13594M.

Section 13595 Entire section revised.

**Supplemental Specification
2005 Standard Specification Book**

SECTION 01284

PROMPT PAYMENT

Add Section 01284:

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. This section applies only to Federal-Aid Contracts.
- B. Requirements applicable to Contractors, subcontractors, service providers, material suppliers, and all tier subcontractors, service providers, and suppliers.

1.2 PROGRESS PAYMENTS

- A. Include in subcontract, service, or purchase agreement language agreeing to pay promptly as required by this specification.
- B. Pay subcontractors for satisfactory performance of sublet work, no later than 10 working days after receipt of payment by the Department.
 - 1. Enter all subcontractor payments into PDBS Subcontractor Payment Screen within 10 days of receipt of payment by the Department. Date entered should reflect actual date payment was sent to subcontractor.
 - 2. Entry of payments into PDBS will serve as the Prompt Payment Affidavit. Actual date of entry is tied to the date the pay estimate is sent to the Comptroller. If the entry date exceeds 15 days from the Comptroller date the entry will flag red, indicating non-compliance with the Prompt Payment Provision.
- C. Pay Material Suppliers and Service Suppliers within 30 calendar days after receipt of payment for work that includes materials and or services.

1.3 RETAINED MONEY

- A. Include in subcontract, service, or purchase agreement language agreeing to pay retained money for subcontract, service, or purchase agreement upon satisfactory completion of the work and acceptance by the Department.
- B. For purposes of this Section, a subcontractor's work is considered satisfactorily completed when all work included in the subcontract is complete, in accordance with all requirements of the contract, and documented as required by the recipient. When a recipient has partially accepted a portion of the work, that portion of work performed is considered to be satisfactorily completed.
- C. Require written notification from the subcontractor when all subcontract items are complete.
 - 1. Notify the Engineer in writing within two working days after written notification from the subcontractor.
 - 2. The Engineer schedules and coordinates an inspection for acceptance of the work within three working days.
 - 3. Receive notification from the Department in writing when the work is considered to be satisfactorily complete and accepted. Acceptance of the work includes all requirements of the contract and agreement on pay quantities.
 - 4. Upon acceptance of the work, the Department releases an amount equal to the subcontractor's retainage. Submit to the Engineer a certified statement:
 - a. In the form of an affidavit on letterhead, including the signature of a legally responsible official, and the signature of a legally responsible official for the subcontractor, certifying that the total amount due is the total retention.
- D. Pay retained money owed to the subcontractor for satisfactory completion of the accepted work no later than 30 calendar days after receipt of payment from the Department.
- E. A determination of satisfactory completion and payment of retained money does not relieve any contractual obligation.

1.4 DELAY OF PAYMENT

- A. Delay payment only for cause, reason documented in comments portion of subcontractor payment screen will serve as notification to the project office.
 - 1. Send written notification to the subcontractor.

- B. Provide subcontractor 10 working days from date of written notification to correct deficiencies.
 - 1. Release payment upon receipt of documentation demonstrating correction of deficiencies within 10 working days.
- C. Engineer may withhold dollar amount of delayed payment from future estimates.
- D. Include in subcontract, service, and purchase agreements, language providing for the use of appropriate alternative dispute resolution mechanisms to resolve time of payment disputes.
- E. Department may hold disputed funds in escrow until the dispute is resolved.

1.5 LIQUIDATED DAMAGES

- A. Upon determination by the Department of failure to make prompt payment the Engineer will provide written notification to the Contractor. Resolve the failure and make prompt payment within three working days.
- B. Failure to resolve prompt payment results in the assessment of \$250 per each working day, per violation, commencing from the date of the written notification until proof of payment is received.
- C. Proof of payment is defined as providing confirmation from the subcontractor that payment has been received.
- D. Department considers the failure to make prompt payment an indication of a lack of financial fitness. The following additional measures may be imposed as necessary:
 - 1. Forfeit the privilege of bidding on Department projects until payment covered by this Section is made.
 - 2. Forfeit the privilege of having a subcontract, supply or purchase agreement approved to perform work or supply materials on Department projects until payment covered by this Section is made.
- E. Department employs other mechanisms, consistent with this Section and applicable state and local law, so payment is fully and promptly made.

1.6 CONTRACTOR INCENTIVE ENTITLEMENT

- A. Two hundred fifty dollars will be paid to Prime Contractor for each subcontractor provided the following criteria is met:
 - 1. Worked on the project.
 - 2. All prompt payment statements submitted to the project office within five working days after payment to subcontractors.
 - 3. Department received no valid complaints regarding prompt payment.

4. Payment within 30 days after project has reached physical completion.

PART 2 PRODUCTS Not used

PART 3 EXECUTION Not used

END SECTION

**Supplemental Specification
2005 Standard Specification Book**

SECTION 02754

DOWEL BAR RETROFIT

Delete Section 02754 in its entirety and replace with the following:

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Procedures and materials for installing coated dowel bars across existing transverse joints and cracks.

1.2 RELATED SECTIONS

- A. Section 03211: Reinforcing Steel and Welded Wire

1.3 REFERENCES

- A. AASHTO M 148: Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
- B. UDOT Accepted Products List (APL)

PART 2 PRODUCTS

2.1 MATERIALS

- A. Dowel Bars: 1½ inch x 18 inch, smooth steel rod, following Section 03211.
- B. Bond Breaking Compound: Use a bond-breaking compound approved by the Engineer.

- C. Chair Devices: Coat according to Section 03211, or make of non-metallic materials, the devices used to support and hold the dowel bar in place.
 - 1. Provide a minimum clearance of ½ inch between the bottom of the bar and the surface upon which the chair is placed.
- D. End Caps:
 - 1. Place on dowels, tight fitting end caps made of non-metallic materials that allows for ¼ -inch movement of the bar at each end.
 - 2. Submit a sample of the end caps to the Engineer for approval prior to use on the project.
- E. Caulking Filler: Submit a sample of the caulking filler to the Engineer for approval prior to use on the project.
- F. Patching Material: Select from the UDOT APL to replace the concrete pavement that was removed to install the dowel bars.
 - 1. Use mix with ¼ inch nominal maximum aggregate size.
 - 2. Submit a sample of the material to the Engineer for approval prior to use on the project.
 - 3. Products not currently on the APL may be added by following the process outlined by the Department.
- G. Joint/Crack Preservation Material: Use a rigid removable material capable of maintaining the joint or crack.

2.2 EQUIPMENT

- A. Jackhammers: To prevent spalling, use jackhammer less than the nominal 30 lb class.

PART 3 EXECUTION

3.1 CONSTRUCTION

- A. Saw cut the pavement as required per PV Series Standard Drawings.
- B. Jackhammer and sand blast to clean all exposed surfaces and cracks, removing slurry and loose concrete.
- C. Clean up and properly dispose of all residues from the saw, jackhammer and sand blasting process.

- D. Place caulking filler in existing joint or crack to prevent intrusion of patching material. See PV Series Standard Drawings.
- E. Pre-coat the dowel bars with a bond-breaking compound.
- F. Place the foam core board on the dowel bar in line with the transverse joint or crack.
- G. Fit the foam core board tightly around the dowel bar and to the bottom and edges of the slot.
- H. Maintain the foam core board in a vertical position and tight to all edges during placement of the patching material as per PV Series Standard Drawings.
- I. Place bars so that the bars do not extend more than 11 inches past the centerline of the slot.
- J. Provide a minimum space of ½ inch in all directions around bar.
- K. Repair or replace any dowel bars damaged at no cost to the Department.
- L. Dampen thoroughly all surfaces of the slot immediately prior to filling with patching material.
 - 1. Prevent standing water in the slot.
 - 2. Remove all excess water with compressed air.
- M. Fill the slot with an approved patching material.
 - 1. Consolidate the material in the slot and around the dowel bar with an appropriate size vibrator.
 - 2. Finish patching materials to existing surfaces.
 - 3. Place and cure the patching material according to manufacturer's specifications.
 - 4. Require a representative from the manufacturer of the patching material to be on-site for the first day's placement.
 - 5. Cure using ASHTO M 148, Type 1-D, Class A.
- N. Replace any individual dowel bar retrofit not functioning or damaged at no cost to the Department.
- O. Remove joint preservation material as needed and repair per to a depth of 2 inches and reseal.

- P. Obtain cores through the slot and dowel system to verify placement of the dowel bar and consolidation of the material around the dowel bar.
1. Obtain three cores from random locations from each of the first three production days.
 2. Use cores from subsequent production days at the discretion of the Engineer.

END OF SECTION

**Supplemental Specification
2005 Standard Specification Book**

SECTION 02765

PAVEMENT MARKING PAINT

Delete Section 02765 in its entirety and replace with the following:

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Furnish Acrylic Water Based pavement marking paint. Refer to this Section, article 2.2 for resin requirement.
- B. Apply to hot mix asphalt or Portland cement as edge lines, center lines, broken lines, guidelines, contrast lines, symbols, and other related markings.
- C. Remove pavement markings.

1.2 REFERENCES

- A. AASHTO M 247: Standard Specification for Glass Beads Used in Traffic Paints
- B. ASTM D 562: Standard Test Method for Consistency of Paints Measuring Krebs Unit (KU) Viscosity Using a Stormer-Type Viscometer
- C. ASTM D 2205: Standard Guide for Selection of Tests for Traffic Paints
- D. ASTM D 2743: Standard Practices for Uniformity of Traffic Paint Vehicle Solids by Spectroscopy and Gas Chromatography
- E. ASTM D 2805: Standard Test Method for Hiding Power of Paints by Reflectometry
- F. ASTM D 3723: Standard Test Method for Pigment Content of Water-Emulsion Paints by Low-Temperature Ashing
- G. ASTM D 3960: Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings

- H. ASTM D 4451: Standard Test Method for Pigment Content of Paints by Low-Temperature Ashing
- I. ASTM D 5381: Standard Guide for X-Ray Fluorescence (XRF) Spectroscopy of Pigments and Extenders
- J. ASTM E 1347: Standard Test Method for Color and Color-Difference Measurement by Tristimulus (Filter) Colorimetry
- K. Federal Standards
- L. Manual on Uniform Traffic Control Devices (MUTCD)
- M. UDOT Materials Manual of Instruction, Part 8
- N. UDOT Minimum Sampling and Testing Requirements

1.3 ACCEPTANCE

- A. Provide documentation of the manufacturer and production batch identification for the paint used.
- B. Provide fixtures (ball valves, gate valves or other) on paint truck for the purposes of obtaining field samples.
- C. Agitate the paint to allow for thorough mixing. Follow paint manufacturer's recommendation for agitation and mixing times.
- D. Stop all agitation before sample is drawn.
- E. Calibrate all meters on the paint truck annually and certify for application rate verification.
 - 1. Use the following calibration tolerances for meters:
 - a. Paint: ± 0.1 gal
 - b. Beads: ± 0.5 lb/gal
 - 2. Keep a clean, legible copy of calibration report with the paint truck.
 - 3. Provide a copy of certification at the Engineer's request.
- F. The Engineer will:
 - 1. Visually inspect lines and legends (symbols and messages) to verify compliance with the required dimensions.
 - 2. Inspect at a minimum at the end of each production day.
 - 3. Verify quantities applied by either of the following methods:
 - a. Measuring both paint and bead tanks prior to and after application.

- b. Witnessing the meter readings prior to and after application.
 - 1) A printout of meter readings, in lieu of witnessing, may be accepted at the Engineer's discretion.
 - 4. Sample in accordance with the UDOT Materials Manual of Instruction, Part 8-932 and the UDOT Minimum Sampling and Testing Requirements.
- G. Repaint any line or legend failing to meet bead adherence and dimensional requirements.
- H. Price Reductions. When more than one of the requirements of the pavement markings is deficient, the result with the highest price reduction governs.
 - 1. Price reductions for pavement markings installed below the specified wet mil thickness are outlined in Table 1.

Table 1

Price Reduction for Wet Mil Thickness	
	Pay Factor
At the specified mil thickness	1.00
1-10 percent below the Specified wet mil thickness	0.75
11-15 percent below the Specified wet mil thickness	0.50
More than 15 percent below the Specified wet mil thickness	0.00 *

* Repaint pavement markings at no cost to UDOT.

- 2. Price reductions for pavement markings installed below the specified total solids, pigment, and non-volatile vehicle content (shown in table 4) are outlined in Table 2.

Table 2

Price Reduction for Total Solids, Pigment and Non-Volatile Vehicle	
	Pay Factor
At or above the specified percentage	1.00
Up to 0.5 percent below the specified percentage	0.85
0.5 to 1.0 percent below the specified percentage	0.70
More than 1.0 percent below the specified percentage	0.00 *

* Repaint pavement markings at no cost to UDOT.

3. Price reductions for pavement markings that fail to meet the remaining requirements of Table 4 are outlined in Table 3.

Table 3

Price Reductions	
	Pay Factor
At the specified requirements	1.00
Up to 1 percent deficient	0.90
1 to 2 percent deficient	0.80
2 to 3 percent deficient	0.70
3 to 4 percent deficient	0.60
4 to 5 percent deficient	0.50
More than 5 percent below specified quantitative requirements	0.00 *

* Repaint pavement markings at no cost to UDOT.

PART 2 PRODUCTS

2.1 PAINT

- A. Meet the requirements for Acrylic Water Based Paint as listed in Table 4:

Table 4

Paint Requirements				
Property	White	Yellow	Black	Test
Pigment: Percent by weight	63.0	63.0	63.0	ASTM D 3723
Total Solids: Percent by weight, minimum	79.0	79.0	79.0	ASTM D 2205
Nonvolatile vehicle: Percent by weight vehicle, minimum*	43.0	43.0	43.0	ASTM D 2205
Viscosity, KU @ 77 degrees F	80 - 95	80 - 95	80 - 95	ASTM D 562
Density, lb/gal	14.1 ± 0.3	14.1 ± 0.3	14.1 ± 0.3	ASTM D 2205
Volatile Organic Content (VOC): lb/gal, maximum	1.25	1.25	1.25	ASTM D 3960
Titanium Dioxide Content, lb/gal	1.0 min	0.2 max	N/A	ASTM D 5381
Color Definition	37875	33538	N/A	Federal Standard 595B
Directional Reflectance: Minimum	90.0	50.0	N/A	ASTM E 1347
Dry Opacity: Minimum (5 mils wet)	0.95	0.95	N/A	ASTM D 2805

* Binder: 100 percent acrylic cross-linking polymer, by weight, as determined by infrared analysis and other chemical analysis available to UDOT (ASTM D 2205).

- B. No-Pick-Up Time
1. Paint may not smear or track three minutes after application to the roadway using standard application equipment, at the mil thickness required, and with an ambient shaded temperature of at least 50 degrees F.
- C. Additional requirements:
1. Free of lead, chromium, or other related heavy metals ASTM D 5381.
 2. ASTM D 2743, ASTM D 4451 and ASTM D 5381: Tests used to verify paint samples meet Accepted Products Listing.

2.2 GLASS SPHERES (BEADS) USED IN PAVEMENT MARKING PAINT

- A. Specific Properties: Meet AASHTO M 247 with the following exceptions.
 - 1. Gradation:

Passing a No. 14 sieve, percent	95 - 100
Passing a No. 16 sieve, percent	80 - 95
Passing a No. 18 sieve, percent	10 - 40
Passing a No. 20 sieve, percent	0 - 5
Passing a No. 25 sieve, percent	0 - 2
 - 2. Beads: Silane adhesion coating.
 - 3. Roundness - The glass beads will have a minimum of 80 percent true spheres.
- B. Beads used in Temporary Pavement Markings meet the above or AASHTO M 247 Type II uniform gradation.

PART 3 EXECUTION

3.1 PREPARATION

- A. Line Control.
 - 1. Establish control points at 100 ft intervals on tangent and at 50 ft intervals on curves.
 - 2. Maintain the line within 2 inches of the established control points and mark the roadway between control points as needed.
 - a. Remove paint that is not placed within tolerance of the established control points and replace at no expense to the Department. Refer to this Section, article 3.4.
 - b. Maintain the line dimension within 10 percent of the width and length dimensions defined in Standard Drawings.
- B. Remove dirt, loose aggregate and other foreign material and follow manufacturer's recommendations for surface preparation.

3.2 APPLICATION

- A. Apply Pavement marking paint at the following wet mil thickness requirements.
1. 20 – 25 wet mils for all longitudinal markings.

Example Calculation: (Verify wet mil thickness)

$$\text{Wet Mils} = \frac{(0.133681 \text{ ft}^3/\text{gal}) * 12000 \text{ mil/ft}}{(X \text{ ft/gal})(Z \text{ ft})}$$

Where,

X = application rate. (Meter readings or dipping tanks).

Z = line width measured in feet.

12000 = conversion from ft to mil

0.133681 = conversion from gallons to cubic feet.

For information only: Approximate application rate for required mil thickness requirements.

- a. 4 inch Solid Line: From 190 to 240 ft/gal
 - b. 4 inch Broken Line: From 760 to 960 ft/gal
 - c. 8 inch Solid Line: From 95 to 120 ft/gal
2. 23 – 40 wet mils for all painted legends as determined by a wet mil gauge.
- C. Refer to Table 1 for pavement markings that are less than required wet mils in thickness.
- D. No additional payment for pavement markings placed in excess of required wet mils in thickness or exceeding dimensional requirements outlined in this Section, article 3.1 paragraph A.
- E. Glass Sphere (Beads): Apply a minimum of 8 lb/gal of paint, the full length and width of line and pavement markings.
1. Do not apply glass beads to contrast lines (black paint).
- F. Begin striping operations no later than 24 hours after ordered by the Engineer.
- G. At time of application apply lines and pavement markings only when the air and pavement temperature are:
1. 50 degrees F and rising for Acrylic Water Based Paint.
- H. Comply with TC Series Standard Drawings.

3.3 CONTRACTOR QUALITY CONTROL

- A. Application Rate: Verify that the paint and beads are being applied within specified tolerances prior to striping.
- B. Curing: Protect the markings until dry or cured. In the event that the uncured marking is damaged the marking will be reapplied and track marks left on the pavement will be removed at no additional cost to the Department.

3.4 REMOVE PAVEMENT MARKINGS

- A. Use one of these removal methods:
 - 1. High pressure water spray,
 - 2. Sand blasting,
 - 3. Shot blasting,
 - 4. Grinding.Grinding is not allowed on the final surfacing unless the Engineer grants prior written approval.
- B. Do not eliminate or obscure existing striping, in lieu of removal, by covering with black paint or any other covering.
 - 1. The Engineer may grant prior written approval for use of black paint or other obscuring material for work durations shorter than “long term stationary” as defined in the Temporary Traffic Control section of the MUTCD.
- C. Use equipment specifically designed for removal of pavement marking material.

END OF SECTION

**Supplemental Specification
2005 Standard Specification Book**

SECTION 02843

CRASH CUSHIONS

Delete Section 02843 and replace with the following:

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Furnish and install crash cushions
- B. Furnish and install crash cushion markings

1.2 RELATED SECTION

- A. Section 02324: Compaction

1.3 REFERENCES

- A. ASTM D 4956: Standard Specification for Retroreflective Sheeting for Traffic Control
- B. Energite® III Module Systems Design Manual
- C. NCHRP Report 350: Recommended Procedures for the Safety Performance Evaluation of Highway Features
- D. UDOT Guidelines for Crash Cushions and Barrier End Treatments, current edition

1.4 SUBMITTALS

- A. Installer Certification.
 - 1. Manufacturer certified installer.
 - 2. Provide proof of certification prior to installation.

- B. Provide a letter of certification for each system location, affirming that each system is installed according to Department's and the manufacturer's specifications.
 - 1. Reference Project Number and describe Station/location indicating median, left or right shoulder or gore area application.

PART 2 PRODUCTS

2.1 CRASH CUSHION

- A. Select from the current approved products list, UDOT Guidelines for Crash Cushions and Barrier End Treatments.
 - 1. Refer to the current UDOT Guidelines for Crash Cushions and Barrier End Treatments for specific uses and requirements for each approved system type. The UDOT Guidelines for Crash Cushion and Barrier End Treatments is maintained by the Division of Traffic and Safety and available through the UDOT Internet home page. Refer to <http://www.udot.utah.gov/index.php/m=c/tid=719>.
 - a. Systems tested under NCHRP-350 requirements and a letter of acceptance issued by FHWA.
 - b. Supply three sets of shop drawings and installation drawings for each system type supplied.
 - 1) Distribute drawings to Contractor, installation contractor, and Engineer or designated representative.
 - 2. Refer to CC series Standard Drawings for each approved system type.
- B. Types:
 - 1. Type A: Protect fixed hazards greater than 3 ft wide within 15 ft of traveled way, with less than 100 ft of longitudinal space in front of the hazard.
 - a. Supply system with an adequate width as specified in plan set.
 - b. Supply system for the required speed as per UDOT's Guidelines for Crash Cushions and Barrier End Treatments, current edition.
 - c. Galvanize all steel parts as per manufacturer's requirements.
 - d. Supply transition element, for the approach of opposing traffic, when system is installed with bi-directional traffic and the system is within 1.2 times the required minimum clear zone.
 - 1) Two transition elements required when system is installed with w-beam median barrier.
 - e. Install system on concrete pad as per manufacturer's requirements.
 - f. Supply crash cushion markings as per CC series Standard Drawings.

2. Type B: To protect fixed hazards up to 3 ft wide or less and within 15 ft of traveled way, with less than 100 ft of longitudinal space in front of the hazard.
 - a. Supply system with an adequate width as specified in plan set.
 - b. Supply system(s) for the required speed as per UDOT's Guidelines for Crash Cushions and Barrier End Treatments, current edition.
 - c. Galvanize all steel parts as per manufacturer's requirements.
 - d. Supply transition element, for the approach of opposing traffic, when system is installed with bi-directional traffic and the system is within 1.2 times the required minimum clear zone.
 - 1) Two transition elements required when system is installed with w-beam median barrier.
 - e. Install system on concrete pad as per manufacturer's requirements.
 - f. Supply crash cushion markings as per CC series Standard Drawings.
3. Type C: To protect fixed objects 3 ft wide or less within 15 ft of traveled way, and longitudinal space in front of the hazard greater than 100 ft.
 - a. Galvanize all steel parts as per manufacturer's requirements.
 - b. Supply double-sided w-beam transition element when system is installed in conjunction with concrete barrier or bridge parapet.
 - c. Supply crash cushion markings as per CC series Standard Drawings.
4. Type D: To protect fixed hazards within 15 ft of traveled way. Use in areas where one impact per year is anticipated or when repair history indicates two or more impacts over a three-year period.
 - a. Supply system with an adequate width as specified in plan set.
 - b. Supply system for the required speed as per UDOT's Guidelines for Crash Cushions and Barrier End Treatments, current edition.
 - c. Galvanize all steel parts as per manufacturer's requirements.
 - d. Supply transition element, for the approach of opposing traffic, when system is installed with bi-directional traffic and the system is within 1.2 times the required minimum clear zone.
 - 1) Two transition elements required when system is installed with w-beam median barrier.
 - e. Install system on concrete pad as per manufacturer's requirements.
 - f. Supply crash cushion markings as per CC series Standard Drawings.
5. Type E - Sand Barrel Arrays: To protect fixed hazards outside of 15 ft from the traveled way and there is an unlimited amount of space. Refer to the UDOT Guidelines for Crash Cushion and Barrier End Treatments for specific uses and requirements of sand barrel arrays.
 - a. Design sand barrel array using Energite® III Module Systems design manual.
 - 1) Design sand barrel array to meet roadway design speed.
 - b. Certify sand barrels and components meet NCHRP-350 for non-redirective, gating crash cushions.

- c. Construct sand barrels using a frangible polyethylene material that will shatter upon impact.
 - 1) Use yellow sand barrels.
 - 2) Permanently apply manufactured date, month, and year to each piece of the barrel system.
 - 3) Use one or two-piece barrel construction.
 - 4) Interface cones with the barrel to prevent leakage of sand but allow for the drainage of excess water for sand barrel systems that use barrel and cone configuration.
 - 5) Provide lids for each sand barrel. Fasten lid securely to barrel.
 - d. Provide sand barrels that hold the required amounts of sand as per requirements of the typical sand barrel array.
 - 1) 200 lb, 400 lb, 700 lb, 1400 lb, and 2100 lb.
 - 2) Mark each barrel in a manner that the amount of sand required for the nominal weight is visible for systems that are designed using barrels for multiple sand weight requirements.
 - e. Use dry sand to fill modules, 2 percent or less moisture.
 - f. Supply crash cushion markings and construct pad as per CC series Standard Drawings.
6. Type F: Use to protect concrete barrier or bridge parapets with less than 150 ft of longitudinal space in front of the hazard. Used in a unidirectional application.
- a. Galvanize all steel parts as per manufacturer's requirements.
 - b. Install system on concrete pad, when specified by manufacturer, and to the manufacturer's specifications.
 - c. Supply crash cushion markings as per CC series Standard Drawings.
7. Type G: Use to protect the approach end of single face w-beam guardrail or approach ends of bridge parapet and concrete barrier with unlimited longitudinal space (greater than 125 ft) in front of the hazard in a unidirectional application, and is installed where a tangent system is desired. W-beam transition element is required when system is installed at the end of bridge parapet or the end of concrete barrier.
- a. Supply post option as described in UDOT Guidelines for Crash Cushion and Barrier End Treatments, current edition.
 - b. Supply system with 12-½ ft galvanized w-beam rail elements as per manufacturer's requirements.
 - c. Supply manufacturer approved impact head and hardware.
 - d. Galvanize all steel parts as per manufacturer's requirements.
 - e. Supply crash cushion markings as per CC series Standard Drawings.

8. Type H: Use to protect the approach end of single face w-beam guardrail or approach end of bridge parapet and concrete barrier with unlimited longitudinal space (greater than 125 ft) in front of the hazard in a unidirectional application, and is installed where a flared system is desired. W-beam transition element is required when system is installed at the end of a bridge parapet or the end of concrete barrier.
 - a. Supply post option as described in UDOT Guidelines for Crash Cushion and Barrier End Treatments current edition.
 - b. Supply system with 12-½ ft galvanized w-beam rail elements as per to manufacturer's requirements.
 - c. Supply manufacturer approved impact head or end section and hardware.
 - d. Galvanize all steel parts as per manufacturer's requirements.
 - e. Supply crash cushion markings as per CC series Standard Drawings.

2.2 CRASH CUSHION MARKINGS

- A. Marker plate: Per CC series Standard Drawings.
 1. Construct marker plate 18 inches x 18 inches using 0.032-gage aluminum with appropriate object marker sheeting.
 - a. Drill a 7/16-inch hole in each corner of plate.
 - b. Use ASTM D 4956 Type III sheeting with encapsulated glass bead retroreflective material, or greater. Use appropriate sheeting type for the substrate sheeting is placed on.
 - c. Use a 24 inch x 14 inch object marker plate or self-adhesive object marker sheeting ASTM D 4956 Type III sheeting with encapsulated glass bead retroreflective material, or greater for Type C systems. Use appropriate sheeting type for the substrate sheeting is placed on.
 - d. Substitution of self-adhesive object marker sheeting ASTM D 4956 Type III sheeting with encapsulated glass bead retroreflective material, or greater, 18 inches x 18 inches or 24 inches x 14 inches placed directly on system for Marker Plate is acceptable.
 - e. Accept object markers supplied by the manufacturer that exceed the above requirements.
- B. Marker Post: Per CC series Standard Drawings
 1. Construct marker post, 60 inches long and 2 inches OD, using black polyethylene material.
 - a. Close top of marker post.
 - b. Drill three 7/16-inch mounting holes.
 - c. Apply three 4-inch bands of yellow sheeting ASTM D 4956 Type III sheeting with encapsulated glass bead retroreflective material, or greater.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Prepare site to finished grade prior to installation of crash cushion or barrier end treatment.
 - 1. Construct approach areas and recovery areas to meet UDOT Standards and system requirements prior to installation of system.
 - a. Refer to CC series Standard Drawings for system requirements.
 - 2. Construct concrete pad, when applicable, to meet system requirements.
 - a. Use manufactures specification for concrete pad construction.
 - b. Refer to CC series Standard Drawings for Type E - sand barrel detail, for pad requirements.
 - 3. Obtain Engineer's approval of site grading, approach and recovery areas, and layout, prior to system installation.
 - 4. Compact backfill material around posts and foundation tubes to minimum 96 percent of maximum laboratory density and dispose of excess material. Refer to Section 02324.
- B. Install in accordance with:
 - 1. UDOT Guidelines for Crash Cushion and Barrier End Treatments.
 - 2. Manufacturer's specifications and recommendations.
 - 3. Use manufacturer certified installer to perform the installation.
- C. Complete repair or replacement of any crash cushion damaged during construction within 24 hours of notification of damage.
 - 1. Contractor is responsible for the cost of repair or replacement of any permanent system damaged for any reason until final acceptance.
 - a. Exception:
 - 1) Damage is caused by an errant vehicle, AND
 - 2) Damage occurs after Traffic has been established in the final lane configuration with shoulders as established in the project plans.
 - b. Payment will be made using a Force Account basis for the cost of repair or replacement of the damaged system when the Engineer determines the conditions described under the exception above apply.

END OF SECTION

**Supplemental Specification
2005 Standard Specification Book**

SECTION 02892

TRAFFIC SIGNAL

Delete Section 02892 in its entirety and replace with the following:

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Materials and procedures for installing traffic signals.
- B. Materials and procedures for installing traffic counting loop detectors.

1.2 RELATED SECTIONS

- A. Section 02466: Drilled Caisson
- B. Section 02741: Hot Mix Asphalt (HMA)
- C. Section 02748: Prime Coat/Tack Coat
- D. Section 02891: Traffic Signs
- E. Section 03055: Portland Cement Concrete
- F. Section 03211: Reinforcing Steel and Welded Wire
- G. Section 03310: Structural Concrete
- H. Section 03575: Flowable Fill

1.3 REFERENCES

- A. ASTM A 123: Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- B. ASTM A 307: Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
- C. ASTM A 325: Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

- D. ASTM A 570: Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality
- E. ASTM B 85: Aluminum-Alloy Die Castings
- F. ASTM B 766: Electrodeposited Coatings of Cadmium
- G. ASTM D 638: Tensile Properties of Plastic
- H. ASTM D 2240: Rubber Property-Durometer Hardness
- I. ASTM D 3005: Low-Temperature Resistant Vinyl Chloride Plastic
Pressure-Sensitive Electrical Insulating Tape
- J. ASTM F 1554: Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-
ksi Yield Strength
- K. American Iron and Steel Institute (AISI)
- L. American National Standards Institute (ANSI)
- M. American Wire Gauge (AWG)
- N. Electric Utility Service Equipment Requirements Committee (EUSERC)
- O. International Municipal Signal Association (IMSA) Standards
- P. National Electrical Code (NEC)
- Q. National Electrical Manufacturers Association (NEMA)
- R. Pedestrian Traffic Control Signal Indicator (PTCSI) Standards
- S. Rural Electrical Association (REA) Bulletin
- T. Underwriters Laboratory (UL)
- U. Vehicle Traffic Control Signal Head (VTCSH) Standards
- V. 3M - 8982/Gel

1.4 SUBMITTALS

- A. Certified test report of wire compliance as specified. IMSA 20-1, 50-2, 51-1, 51-3, 51-5, 51-7, 60-6.
- B. Submit samples of materials for approval when requested.
- C. Submit two copies of the following within 15 days after receiving notice to proceed:
 - 1. List of equipment and materials (name of manufacturer, size, and identification number).
 - 2. Detailed shop drawing, wiring diagrams, and certifications.
 - 3. Manufacturers' warranties, guarantees, instruction sheets, and parts lists.
- D. Submit UDOT Vehicle Detector and Street Lighting Splice certifications for all individuals that will perform wiring splices.

1.5 ACCEPTANCE

- A. Signal Warranties and Guarantees
 - 1. The notice of acceptance for traffic signal work is not given until six months after the date of completion of punch list items.
 - 2. During this period, all manufacturer's warranties and guarantees on Contractor-furnished electrical and mechanical equipment are enforced.
 - 3. At the end of the period and after all electrical and mechanical defects within the scope of warranties and guarantees are corrected, the Engineer makes written acceptance of the work completed and relieves the Contractor of further responsibility for that portion of the project.
 - 4. Partial acceptance does not void or alter any terms of the Contract
- B. The six-month warranty period for signal work does not affect the processing of a semi-final estimate when the Contract is 95 percent or more complete, or after completion of work on the project.

C. Detector Loop Circuit: Conduct the following acceptance tests before and after backfill for approval by the Engineer.

1. Measure and report in ohms, the continuity of each loop.
2. Value to be within 5 percent of calculated values.
3. Loop Resistance Formula: $R_t = R_l + R_d$

Where:

- R_t = Resistance of loop as measured at pull box.
 R_l = Resistance of loop lead in wire (from the loop to junction box).
 Equal to 0.002525 ohms per foot, (times 2) measured from loop to pull box splice point.
 R_d = Resistance of Loop = $P \cdot T \cdot R_c$ (See Loop Resistance Table below)
 P = Perimeter of loop in feet
 T = Number of turns in the loop.
 R_c = Resistance of #14 AWG copper wire per foot equals 0.002525 ohms.

Table 1

Loop Resistance			
Loop Type			R_d Loop Resistance (ohms)
Width (ft)	Length (ft)	Turns	
5	6	4	0.22
5	10	4	0.32
6	Circular	4	0.19
6	Circular	5	0.24
6	6	4	0.24
6	10	4	0.32
6	12	4	0.36
6	14	3	0.30
6	16	3	0.33

4. Measure and report each loop's insulation resistance. Minimum acceptable reading measured between the loop conductor and ground is 450 M Ω or greater, when tested with a 500 V megger meter.
5. Measure and report the inductance of each loop. Acceptable inductance readings are greater than 90 μ H for individual loops, and less than 1000 μ H for a 4 loop group.

- D. Signal Power Circuits:
 - 1. Measure and report continuity of bonding conductors by testing between AC+ supply and metal poles: A 1000 Watt load, tested to each pole frame must incur less than 2 Volts drop, measured from the pole to the cabinet neutral conductor.
 - 2. Insulation resistance of supply conductors measured to ground will have not less than 100 MΩ of leakage (500 V megger meter).
- E. Video Detection Circuit: Demonstrate each video detection circuit operates per manufacturer's specifications.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Use electrical components as listed and defined by the NEC.

2.2 SIGNAL POLE AND TRAFFIC SIGNAL LIGHT SUPPORT ARM

- A. Post Mounted Signals Pole:
 - 1. Steel, as specified. ASTM A 570, Grade 33.
Allowable stresses: $F_b = 21,750 \text{ psi } (0.66F_y)$
 $F_v = 10,900 \text{ psi } (0.33 F_y)$
 - 2. Galvanized as specified. ASTM A 123.
 - 3. Wind load: 80 mph wind with 105 mph gusts.
- B. Foundation:
 - 1. Concrete: Class AA(AE) Concrete. Refer to Section 03055.
 - 2. Reinforcing steel: Coated steel. Refer to Section 03211.

2.3 BOLTS, NUTS AND HARDWARE

- A. Anchor Bolts and Nuts:
 - 1. Steel as specified. Signal, CCTV, and Luminaire Poles use ASTM F 1554 Grade 55; Signal Cabinet use ASTM A 307.
 - 2. Zinc-plated or galvanized, as specified.
 - a. Zinc-plated as specified. ASTM B 766.
 - b. Galvanized steel: ASTM A 123.
 - 3. Nuts: Free running by hand for total thread length of bolt.
- B. Slip Bolts as specified.
 - 1. Zinc plated: ASTM B 766.
 - 2. Steel: ASTM A325.

2.4 WIRE

- A. Copper, as specified. International Municipal Signal Association (IMSA)
- B. Size as specified. AWG
- C. Service Cable:
 - 1. Single-conductor, as specified. Types RHH-USE-RHW.
- D. Interconnect cable:
 - 1. Twisted pair filled shielded cable, as specified. IMSA 60-6.
 - 2. Single mode fiber optic cable, as specified.
- E. Signal Cable:
 - 1. Multi-colored cables, as specified. IMSA 20-1
- F. Bonding/Grounding System Wire:
 - 1. Solid, bare, soft-drawn, copper wire, as specified. Sized to meet NEC 250-1.
- G. Detector Lead-In Wire (homerun): as specified. IMSA 50-2.
- H. Detector Loop Wire:
 - 1. PVC Sensor Loop Wire – No. 14, single-conductor, stranded wire as specified. IMSA 51-3.
 - 2. Saw Cut Sensor Loop Wire – No. 14, single-conductor, stranded wire encased in a polyethylene tube as specified. IMSA 51-7.
- I. Commercially Manufactured Preformed Loop:
 - 1. Highly abrasion-resistant alloy cover with high tensile strength braided synthetic fiber reinforcement, max. O.D. of 3/8 inch.
 - 2. Withstand minimum pressure of 1400 psi.
 - 3. Good flexibility over a wide temperature range and rated to withstand the temperatures of an asphalt overlay project.
 - 4. Superior resistance to oil, gasoline, salt, moisture and impact.
 - 5. Loops shall be individually marked as to the direction of the wire turns.
 - 6. Manufacturer to provide minimum 15 year guarantee.
- J. Splice Sealing: Rural Electrical Association (REA) Bulletin 17551-100.
 - 1. Insulate conductors individually and encapsulate with mastic rubber pads and over wrap with vinyl electric tape. Overcoat completed splice with waterproof sealant. ASTM D 3005, Type I or II. UL 510.
- K. Color Coding Tape:
 - 1. Vinyl electric tape, as specified. UL 510.

- L. Video Detection Circuit:
 - 1. Video Detection/Camera Power Circuit Cable: As specified per manufacturer requirements.

2.5 VEHICLE TRAFFIC SIGNAL HEAD

- A. Comply with VTCSH standards. Refer to SL Series Standard Drawings.
- B. Signal Head Assembly:
 - 1. 12-inch vehicular signal head as specified.
 - 2. Separate, interchangeable, and expandable without tie rods.
 - 3. Stainless steel bolts, screws, hinge pins, lugs, and hardware.
 - 4. Die-cast aluminum parts, including the doors, as specified: ASTM B 85. Clean, smooth parts free from flaws, cracks, blowholes, or other imperfections.
 - 5. Perimeter door gasket to provide moisture and dust resistant seal.
 - 6. Mounting hardware for securing LED module to door housing.
 - 7. Integrally round serrated boss openings in the top and bottom of each section that accepts a standard 1.5-inch pipe mounting or universal bracket mounting hardware. Capable of adjusting a full 360 degrees around a vertical axis.
 - 8. 6-position wiring terminal strip.
 - 9. Tunnel visor securely mounted to the door at a minimum of four attachment points.
 - 10. Powder coat all exterior and interior surfaces of the signal housing, door, and outside of visor in Highway Yellow. Inside of visor is painted flat black.
- C. Optical Unit:
 - 1. Mount LED Ball and Arrow Vehicle Signal Module to door housing for unrestricted easy access.
- D. Back Plate:
 - 1. Constructed with minimum 18-gage aluminum.
 - 2. Provide louvered design to reduce wind loading on mast arm structure.
 - 3. Both sides primed and painted flat black.
 - 4. Designed to be attached to the signal head used.

2.6 PEDESTRIAN SIGNAL HEAD

- A. Comply with PTCSI standards. Refer to SL Series Standard Drawings.
- B. Signal Head Assembly:
 - 1. Provide 16-inch by 18-inch housing, swing down door assembly, and LED module.

2. Moisture and dust resistant.
 3. Die cast, single piece aluminum with 1-1/2 inch top and bottom openings, and integrally cast shurlock boss. Use stainless steel screws and assembly hardware.
 4. Swing down door assembly capable of being opened without tools, constructed from single piece aluminum alloy, die cast with two hinge lugs at the bottom and two latch slots at the top of the door. Universal housing with interchangeable castings for hinge and latch hardware is acceptable.
 5. 3-position wiring terminal strip.
 6. Provide electrostatic apply synthetic enamel as specified. Gloss black case and doorframe. Oven-cure finish for a minimum of 20 minutes at 350 degrees F.
- C. Optical Unit:
1. Mount LED Pedestrian Signal and Count Down Pedestrian Signal Modules to door housing for unrestricted easy access.

2.7 PEDESTRIAN BUTTONS

- A. Refer to SL Series Standard Drawings.
- B. Pedestrian Button with LED Indicator
1. Provide pedestrian button with standard 4-bolt circle (2.60-inch +/- 0.05-inch diameter).
 2. Provide ADA compliant assembly with a 2 inch diameter stainless steel actuator, rated for 100 million actuations, requiring between 1 and 3 pounds of force to actuate.
 3. Provide a low-movement (maximum movement of 12/1000 of an inch), pressure activated, tamper-proof, highly vandal resistant button.
 4. Provide assembly with solid state electronic Piezo switch rated for 100 million cycles with no moving plunger or moving electrical contacts.
 5. Provide assembly with internal circuitry with a resetting switch so as to avoid held calls to the signal controller.
 6. Provide assembly with built in surge protection, with all switch electronics sealed within the cast aluminum housing. Enclose all supporting circuitry within the button with wiring to the pushbutton terminated on two screw terminals.
 7. Provide a rain-tight gasket to seal between the button assembly and the frame.
 8. Provide assembly that is designed to prevent water and ice from entering or accumulating on or in the button, and that is capable of protecting the button cap from side impacts.

9. Provide button that gives feedback to the user that a call has been made in both of the following forms:
 - a. Audible beep when button is pushed.
 - b. Momentary LED light as the button is pushed, or LED light stays on for 3-5 seconds if the button is pushed and held closed.
- C. Pedestrian Push Button Frame
 1. Provide cast aluminum frame, powder coated black, capable of supporting push button and a 9 inch x 12 inch sign, with the following characteristics:
 - a. Frame attaches to the pole using two ¼ inch -20 x 1.5-inch hex head brass bolts attached behind the sign.
 - b. Frame is additionally supported using adjustable staves.
 - c. Sign attaches above the button using 8-32 stainless steel Allen-head screws.
 - d. Cable guide extends through a 7/8 inch diameter mounting hole in the support pole to channel wiring to the button.
- D. Pedestrian Push Button Sign
 1. Provide a 9 inch x 12 inch sign with corner radii that allow the sign to fit completely within the frame.
 2. Provide a two-sided R10-4b sign, with one side of the sign with a right arrow and the other side of the sign with a left arrow.
 3. Provide sign fabricated from aluminum substrate using ASTM Type III or higher reflective sheeting (sign Type A1) with standard 8-32 clearance holes or eyelets for mounting.

2.8 LED SIGNAL MODULES

- A. LED Signal Module Standards:
 1. Use new LED vehicle signal modules that meet current VTCSH standards.
 2. Use new LED pedestrian and countdown signal modules that meet current PTCSI standards.
- B. Physical Requirements:
 1. Use modules that fit into traffic signal housing without modification to the housing.
 2. Use retrofit replacement modules that only require removal of the existing optical unit components, i.e., lens, lamp module, gaskets, and reflector.
 3. Watertight and dust resistant module that securely fits the housing door and wire pigtails for direct connection to wiring terminal strip. Screw-in modules are not acceptable.
 4. Provide tinted lens for all LED modules.
 5. Use LED modules that have the appearance of an incandescent traffic signal lens and wide angle viewing capability.

- C. Additional Requirements for Pedestrian Signal Modules:
 - 1. Provide 9-inch countdown numerals when specified.
 - 2. Provide symbol message that blanks out under ambient light conditions when the pedestrian symbols are not active.
 - 3. Provide circuitry that isolates man/hand symbols so they cannot be displayed at the same time.
- D. Manufacturer Warranty:
 - 1. Provide the following minimum warranty provisions:
 - a. Replace or repair module if it fails to function as intended due to workmanship or material defects within the first 84 months from the date of delivery. If repaired, the warranty covers all parts and labor necessary or incidental to the repair.
 - b. Provide all guarantees that are customarily issued by the Bidder or manufacturer to the State of Utah.
 - c. UDOT, or their appointee, may elect to make minor repairs, with the consent of the manufacturer. Make all other repairs under warranty by the manufacturer. The manufacturer bears all costs including labor, parts, and shipping charges.
 - d. Replace or repair all LED Vehicle Traffic Signal Modules that exhibit luminous intensities less than the minimum values specified in **Article H-1a** within the first 60 months of the date of delivery.

2.9 ELECTRICAL CONDUIT

- A. Conduit and fittings:
 - 1. Schedule 40 PVC rated at 190 degrees F as specified. NEMA TC-2, TC-3. UL Listed.
 - 2. Rigid steel as specified. UL 6.
 - 3. Galvanized as specified. ANSI C80.1.
- B. Steel Casing:
 - 1. Provide smooth steel casing with a minimum 1/4-inch wall thickness and diameter as specified.

2.10 VEHICLE DETECTION

- A. Refer to SL Series Standard Drawings.
- B. Video Detection:
 - 1. State-furnished video detection equipment as specified. Refer to UDOT Accepted Products List for approved manufacturers.

- C. Induction Loop Detection:
 - 1. PVC or preformed loops:
 - a. Use for presence detection, traffic queue detection, and dilemma zone detection.
 - 2. Saw Cut loops:
 - a. Use for presence detection, traffic queue detection, and dilemma zone detection.
 - b. Use circular loop saw or standard pavement saw. Square loops require corner cuts. Avoid saw angles greater than 45 degrees.
- D. Radar Detection:
 - 1. Use for dilemma zone detection for typical high-speed approaches, and advance signal warning systems.
 - 2. Use for vehicle counting.

2.11 LOOP SEALANT

- A. Refer to SL Series Standard Drawings.
- B. Traffic loop embedding sealant:
 - 1. Isophthalic, acid-based, unsaturated, polyester resin.
 - 2. With sufficient adhesion, strength, and flexibility to:
 - a. Withstand normal movement in asphaltic and concrete pavements
 - b. Protect the loop wire from moisture penetration, fracture and shear.
 - 3. Cured sealant resistant to motor oils, gasoline, anti-freeze solution, brake fluid, and de-icing chemicals.
 - 4. Meet the physical property requirements in Table 2.

Table 2

Traffic Loop Embedding Sealant		
Physical Properties	Test	
Shore D Hardness	ASTM D 2240	50-65
Specific Gravity		1.13 - 1.20
Styrene Monomer, percent		28 - 32
Viscosity: Pa·s	Brookfield Model LVF #3 Spindle @ 60 rpm	0.7-0.9
Gel Time	MEK Peroxide 46-709	11 - 15 minutes
Tensile Elongation, % @ Break	ASTM D 638	15 minimum
Pot life, minimum		5 minutes
Tensile Strength	ASTM D 638	1200 psi

2.12 LUMINAIRE

- A. General:
 - 1. Die-cast aluminum housing.
 - 2. Reflectors, sockets, mounting cradles, and clamps fitted to the upper housing.
 - 3. High temperature wiring.
 - 4. Luminaire weight and projected area within design loading limits.
 - 5. Refer to SL Series Standard Drawings.
- B. Ballast Assembly:
 - 1. Pre-wired on integral ballast with quick disconnect plugs mounted on a removable, hinged door.
 - 2. Multi-volt, multi-watt ballast.
 - 3. Provide correct ballast assembly for the specified lamp type:
 - a. High-pressure sodium.
 - b. Metal halide.
- C. Optical Assembly:
 - 1. Formed aluminum reflectors with a chemically bonded, non-breakable, glass finish on both the inside and outside surfaces.
- D. Mogul Base Socket:
 - 1. Adjustable with split-shell, tempered-brass lamp grips.
 - 2. Free-floating, spring loaded center contacts.
 - 3. Heat and impact-resistant glass prismatic refractors.
- E. Mounting Adjustment:
 - 1. Standard Highway Luminaire (Cobra Head):
 - a. Ten degrees above horizontal for the reflector and refractor.
 - b. Five degrees adjustment from vertical on the bracket arm.
- F. Lamp:
 - 1. High pressure sodium lamp as specified:
 - a. Clear uncoated lamp.
 - b. Apparent color temperature of 2100 K.
 - c. Rated-life of not less than 24,000 hours when used on a 10 hour per start duty cycle.
 - 2. Metal halide lamp as specified:
 - a. Clear uncoated, pulse start lamp.
 - b. Apparent color temperature of 3800 K.
 - c. Rated-life of not less than 20,000 hours (400 Watt) or 10,000 hours (250 Watt) when used on a 10 hour per start duty cycle.

2.13 GROUND ROD

- A. Copper-coated steel as specified.
- B. ANSI/UL 467.

2.14 MESSENGER CABLE

- A. 3/8 inch diameter galvanized, stranded steel cable.
- B. Minimum breaking strength of 10,800 lb as specified.
- C. ASTM A 123.

2.15 MOUNTING BANDS AND BUCKLES

- A. As specified.
- B. AISI Type 201.

2.16 POWER SOURCE

- A. Refer to SL Series Standard Drawings.
- B. Pole Mounted Service:
 - 1. NEMA wet service rated service enclosure.
 - 2. Provide a manual EUSERC approved circuit closing link by-pass release meter socket.
 - 3. Other requirements as specified and as required by the local power company. Provide a product consistent with specifications for Underground Service Pedestal.
- C. Underground Service Pedestal:
 - 1. Service Disconnect:
 - a. Provide pedestal rated for 100-amp, 1-Phase 3-wire 120/240v service.
 - b. Provide 200-amp utility landing lugs rated for 250 MCM wire.
 - c. Provide pedestal that is split into an “un-metered” and a “metered” side.
 - d. Provide plug in circuit breakers that are UL approved, industrial grade, and rated for 10K AIC minimum.

- e. Provide one double pole 70-amp main circuit breaker labeled “Metered Main” and one single pole 40-amp circuit breaker labeled “Traffic Signal” with minimum capacity for four metered single pole circuit breakers. Provide traffic signal circuit breaker that is secondary to the metered main breaker.
- f. Provide one double pole 50-amp main circuit breaker labeled “Un-metered Main” and one double pole 20-amp circuit breaker labeled “Lighting” with minimum capacity for four un-metered double-pole circuit breakers. Provide lighting circuit breaker that is secondary to the un-metered main circuit breaker.
- 2. Provide pedestal that is pre-wired according to NEC and NEMA Specification with UL approved copper XHHW-2 cable bussing, fully rated. Provide provisions for terminating to a ground rod.
- 3. Provide pedestal with UL 508 rating.
- 4. Provide self-standing NEMA 3R cabinet (direct burial pedestals are not acceptable) with gasket in place, fabricated of 0.120 inch minimum thickness anodized aluminum.
 - a. Provide all exterior components that are rustproof.
 - b. Provide exterior that has no exposed hardware except for handles.
- 5. Meet EUSERC requirements for all mounting hardware and installation details. Fit with EUSERC approved power meter base with manual link bypass.
- 6. Provide pedestal with service entrance, meter and distribution compartments with a corrosion resistant barrier to separate each compartment. Provide access panel or door with stainless steel piano hinges.
- 7. Provide cabinet with sealed window(s) of shatter resistant Lexan (or equivalent). Provide a meter that can be read from the front of the cabinet.
- 8. Provide documentation that is permanently and conveniently attached and includes the manufacturer’s name, address, phone number, a wiring diagram, date of manufacture, and all necessary information to order an identical pedestal and replacement parts.
- 9. Provide labels that are permanent (etched or engraved) and mechanically fastened to the cabinet. Label the front exterior of the cabinet “UDOT SIGNAL AND LIGHTING DISCONNECT.”

2.17 FLOWABLE FILL

- A. Refer to Section 03575.

2.18 HOT MIX ASPHALT

- A. Half-inch nominal. Refer to Section 02741.

2.19 MAST ARM SIGNS

- A. Provide sign fabricated from aluminum with Type III High Intensity sheeting (minimum). Refer to Section 02891.

PART 3 EXECUTION

3.1 PREPARATION

- A. Conform to the NEC.
- B. Coordinate State Furnished Materials:
 - 1. Pick up at the Department's Central Warehouse, 4501 South 2700 West, Salt Lake City, UT. Contact the warehouse to schedule a pickup.
 - 2. Pick up drop shipment materials at location specified.
- C. Do not disconnect or remove an existing signal system until the replacement system is functioning.
- D. Contact power company at least 30 days before the connection date, and verify the exact location, voltage, procedure, and materials required by the power company.
- E. Pothole, locate, and expose any utility that will conflict with drilling, trenching, or boring work associated with placement of signal/pedestrian poles and conduit.
- F. Reuse materials only as specified or as approved by the Engineer.

3.2 CONSTRUCT POLE FOUNDATION

- A. Refer to SL Series Standard Drawings.
- B. Concrete: AA(AE) required. Refer to Section 03055.
- C. Structural Concrete: Refer to Section 03310.
- D. Reinforcing Steel and Welded Wire: Refer to Section 03211.
- E. Do not weld reinforcing steel, anchor bolts, or conduit.
 - 1. Use tie wire to secure conduit.
 - 2. Use template to align and secure anchor bolts.

- F. Drilled Caisson: Refer to Section 02466. Place concrete directly in excavation. Use minimum forming above ground.

3.3 STEEL PLACEMENT

- A. Install poles plum (vertically straight).
- B. For signal poles, tighten anchor bolt nuts to snug-tight plus 1/3 turn.
- C. For poles with break-away slip base systems, tighten anchor bolt nuts as shown on SL Series Standard Drawings.
- D. Field assemble two-piece mast arm slip joint to achieve a snug fit. Apply anti-seize compound and provide overlap not less than 1.5 times inside diameter of end section.

3.4 TRENCHING AND DIRECTIONAL BORING FOR CONDUIT

- A. Trenching Paved Surface (asphalt concrete):
 - 1. Do not use backhoe.
 - 2. Make the trench 6-inches wide or less.
 - 3. Use flowable fill to within 3-inches of the existing roadway surface.
 - 4. Evenly apply tack coat before final backfill.
 - 5. Match the composition, density, and elevation ($\pm 3/16$ -inch) of the existing surface in the final 3-inches of backfill.
- B. Trenching Unpaved Surface:
 - 1. Use backfill that matches the composition, density, and elevation ($\pm 3/16$ -inch) of the existing surface.
 - 2. Install conduits that cross finished curbs and gutters, sidewalks, concrete flatwork, textured or decorative surfaces by jacking, drilling, or pushing. Entirely replace any damaged section at no additional cost to Department.
 - 3. Dispose of surplus material daily.
- C. Trenching under Railroad:
 - 1. As specified in railroad agreement.
- D. Minimum cover of conduit:
 - 1. Minimum cover for all roadway crossings: 24-inches for conduit placed in trench; and 36-inches for directional bore conduit.
 - 2. Minimum cover off roadway without concrete encasement or capping: 18-inches.
 - 3. Minimum cover off roadway with concrete encasement or capping with minimum thickness of 2-inches: 12-inches.

- D. Directional Boring:
 - 1. Directional boring is an approved alternative to trenching unless otherwise specified.

3.5 INSTALL CONDUIT

- A. Place all conduits in the same trench before surfacing.
- B. Use galvanized rigid steel conduit above ground. Use PVC conduit under ground.
- C. Seal uncapped conduit ends inside junction box with at least 2-inches of duct caulking or PVC cap.
- D. Install No. 14 AWG single conductor copper, type THHN pull wire in all unused/future-use conduit.
 - 1. On each end of conduit install cap with $\frac{7}{32}$ -inch hole for pull wire.
 - 2. Leave 20-inches of wire outside of the cap, fastened securely.
 - 3. Place future-use conduit in top portion of junction boxes for future access.
- E. Secure conduit on structures with standard galvanized iron conduit clamps using at least $\frac{5}{16}$ -inch diameter concrete expansion anchors at maximum 60-inch spacing.
- F. Use conduit expansion fittings at structure expansion joint crossings.

3.6 INSTALL WIRING

- A. Conductors:
 - 1. Clean and dry the inside of the conduit before installing conductors.
 - 2. Install grounding conductor in all power circuit conduits.
 - 3. Use powered soapstone, talc or other approved lubricants when pulling conductors in conduit.
 - 4. Tape the ends of unused conductors and label them as spares.
 - 5. Use conductors that are color coded as specified. See table 4. Meet IMSA 20-1.
- B. Bonding Conductor (Ground) Wire:
 - 1. Size bonding wire in conformance to NEC article 250. Run continuously and bond to each metal signal pole.
 - 2. Bond the grounding system conductor to the ground rod in each junction box except in circuits with less than 50 V.
- C. Arrange the wiring neatly within cabinets, junction boxes, fixtures, etc.
- D. Terminate all terminal connections by a mechanical (spade) connector.

- E. Loop Detection Wire Splicing:
1. Permit cable splices only in detection circuits where the wire type changes in the junction boxes. No other splices are allowed.
 - a. Strip insulation back on the ends of the shielded cable wires and all of the loop wires that are to be joined in series to allow a non-insulated butt splice to be crimped onto them with a $\frac{1}{8}$ -inch of copper extending past the end of the butt splice.
 - b. Strip loop ends as needed. Strip home run cable as needed and cut off the bare conductor drain wire. Use non-insulated butt splice connectors and crimp the loop leads to the home run leads then solder these connections.
 - c. Use an electric or butane soldering iron to solder the splices when all pairs have been joined as specified above so that solder covers the splice inside and out. Do not melt the insulation.
 - d. Wrap each soldered connection with black tape and mastic tape so that the non-insulated butt splices will not short circuit. Wrap entire splice with mastic tape then wrap the entire splice area with black tape. Be sure to overlap the outer sheaths on the home run and the loop leads by 1-inch. Apply waterproof sealant over the black tape and let dry.
 - e. Use a nylon tie wrap to secure the loop leads at the best location possible inside the pull box. Provide loop leads that are at least 48-inches long as measured from the top of the pull box to allow the Contractor to work on the splice above the box.
- F. Mark cabinet cables with colored vinyl electrical tape as specified in Table 3. Meet UL 510.

Table 3

Cables Marked with Colored Tape				
	Northbound P2	Southbound P3	Eastbound P4	Westbound P1
Signal Circuit	Blue	Red	Yellow	Orange
Detector Circuit	Blue	Red	Yellow	Orange
	Circuit Coding One band = Through, Two bands = Left Turn, Three bands = Queue, Four bands = Dilemma			
Pedestrian Head Circuit	Blue & Green	Red & Green	Yellow & Green	Orange & Green
Pedestrian Button Circuit (3)	Blue & White	Red & White	Yellow & White	Orange & White

- G. Connect conductors according to Table 4.

Table 4		
Color-Coded Conductors		
	North-South	East-West
Seven-Conductor Pedestrian Circuit	Red – Don't Walk Green -Walk White – Neutral	Black - Spare Orange – Don't Walk Blue - Walk White with Black Tracer - Neutral
Four -Conductor Pedestrian Head Circuit Push Button Circuit	Red – Pedestrian Call White - Common	Black - Pedestrian Call White - Common
Seven-Conductor Signal Circuit	White – Neutral Red - Red Through Orange - Yellow Through Green - Green Through Blue - Green Arrow White with Black Tracer - Yellow Left Black - Left red or spare	

3.7 INSTALL DETECTOR LOOPS

- A. Refer to SL Series Standard Drawings.
- B. One turn is once around the perimeter of the loop with the same conductor.
1. Use number of turns as specified in Table 1 (Loop Resistance Table).
 2. Do not allow twists in the loop.
 3. No splices are allowed in loop
- C. Loop lead-in from loop to junction box:
1. Minimum of 3 twists per foot in saw cut.
 2. Minimum of 6 twists per foot inside of conduit.
 3. Do not interweave with other loop lead-ins.
 4. Each lead-in requires a separate conduit.
- D. For Detector Lead-in (feeder) from the junction box to controller cabinet, carry shield continuity across all splices.
- E. Saw cut loop:
1. Only circular loops may be saw cut into existing surfaces.
 2. Remove all loose material and wash and dry all saw cuts.
 3. Place all loop wire in a ¼-inch polyethylene tube.

4. Seat the conductor with no damage at the bottom of the slot. Place 1-inch backer rod pieces 18-inches along saw slot to prevent loop wires from floating upward in sealant.
 5. Fill the saw cut with embedding sealant; surround the polyethylene tube to the level of the existing roadway surface. Remove any excess embedding sealant.
- F. Preformed loop:
1. Trench 6-inch maximum width with 6-inch minimum to 12-inch maximum cover, in order to place loops below the pavement section.
 2. Include an additional turn in loops that are more than 8 inches below finished surface to compensate for reduced sensitivity.
 3. Anchor sensor loops to prevent movement or floating.
 4. Apply a tack coat to the sides and the bottom of trench and backfill with hot mix asphalt, ½ -inch nominal aggregate mix for loops trenched under existing asphalt. Refer to Sections 02741 and 02748. Compact with flat nose on a jack hammer in 3-inch maximum lifts.
 5. Preform and place loops under new pavement 1 ¾-inches below the surface of the base course and backfill with surrounding material.

3.8 INSTALL POWER SOURCE

- A. Verify the exact location, voltage, procedure, and materials required by the power company.
- B. Refer to SL Series Standard Drawings.

3.9 INSTALL LUMINAIRE

- A. As specified.
- B. Refer to SL Series Standard Drawings.

3.10 INSTALL SIGNAL HEAD

- A. Refer to SL Series Standard Drawings.
- B. Do not install signal heads at the intersection until ready for operation.
- C. Completely cover the vehicle signal heads with orange non-transparent, plastic garbage bags tied securely around the signal head if turn on is not immediate. New signal heads must not block active existing signals prior to new signal turn on.

- D. Install optically-programmed signal heads in accordance with the manufacturers instructions.
- E. Use louvered back plates on all signal heads except Type V.
- F. Use cable straps for all universal signal mounts.

3.11 INSTALL MAST ARM SIGNS

- A. Attach mast arm sign with mounting brackets using stainless steel straps. Do not drill holes in poles except as shown on the plans.
- B. Mount sign on mast arm so that the legend/message is horizontal, even if on a curved section of mast arm.

3.12 REMOVE AND SALVAGE EXISTING EQUIPMENT

- A. Light poles, signal poles, messenger cable, signal and pedestrian heads, controller cabinets, other items as specified on the plans remain the property of the Department.
- B. Transport items to the specified location.
- C. Remove foundations to a depth of at least 6-inches below the existing surface.
- D. Backfill all holes with local material and compact to the density of the surrounding area.

3.13 INSTALL VIDEO DETECTION

- A. Install all video detection components in accordance with the manufacturer specifications.
- B. Mount each video detection camera on the signal mast arm using the State-Furnished 46-inch extension pole and mounting bracket. Refer to SL Series Standard Drawings for camera placement mount.
- C. Install video detection cameras under the direction and supervision of UDOT staff, as specified. Provide a fully functional detection system.

END OF SECTION

**Supplemental Specification
2005 Standard Specification Book**

SECTION 13551

GENERAL ATMS REQUIREMENTS

Delete Section 13551 and replace with the following:

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Materials and procedures for installing all ATMS components as defined in the contract.
- B. Provide all documentation required for the installation and testing of ATMS components.

1.2 RELATED SECTIONS

- A. Section 00725: Scope of Work
- B. Section 01554: Traffic Control
- C. Section 01721: Survey
- D. Section 13591: Traffic Monitoring Detector Loop
- E. Section 13595: ATMS Integration

1.3 REFERENCES

- A. AASHTO M 232: Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware (nuts, washers, and anchor bolts)
- B. AASHTO M 314: Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
- C. AASHTO Roadside Design Guide (current edition)

- D. AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals (current edition)
- E. ASTM D 3005, Type I or II. UL 510
- F. American Wire Gauge (AWG)
- G. International Building Code (IBC)
- H. International Municipal Signal Association (IMSA)
- I. Manual on Uniform Traffic Control Devices (MUTCD; current edition)
- J. National Electrical Code (NEC)
- K. National Electrical Safety Code (NESC)
- L. Rural Electrical Association (REA) Bulletins
- M. USDA Rural Utilities Service (RUS) Bulletin
- N. Underwriters Laboratory (UL)

1.4 DEFINITIONS

- A. ATMS - Advanced Traffic Management System
- B. CCTV - Closed Circuit Television
- C. RMS - Ramp Meter System
- D. RWIS - Road Weather Information System
- E. TMS - Traffic Monitoring Station
- F. VMS - Variable Message Sign
- G. WIM - Weigh In Motion

1.5 SUBMITTALS

- A. Provide two copies of all documentation to the Engineer. Install one additional copy in a weatherproof sealable sleeve and place in each field cabinet.

- B. The general purpose and content of all required submittals is described in Table 1. Refer to the appropriate specifications for details of the submittal requirements and test procedures for each ATMS device. Obtain UDOT's newest version of the test procedures for the local field operations test from the UDOT website. Refer to <http://www.udot.utah.gov/index.php/m=c/tid=719>.

Table 1
Submittal Requirements

Name	Timeline	Description
Contractor Furnished Material and Equipment Lists	Submit within 15 business days from Notice to Proceed.	Include the name of manufacturer, size, and identification number. Obtain approval from the Engineer before ordering any contractor furnished equipment.
Test Reports (for Cable and Conductor Test, the Local Field Operations Test, and Acceptance Tests.)	Submit within five business days from the completion of a successful test.	Provide after the completion of a successful test. Test Reports are required for each appropriate ATMS device installation, including, but not limited to CCTV, VMS, RWIS, WIM, Traffic Monitoring Detector Loops or other specified detection device, and Fiber Optic Communication Systems. Provide Test Reports in a neatly bound (3-hole) and printed format. Include the following in the Test Reports: <ul style="list-style-type: none"> 1) All test results (including failed tests) 2) Description of any observed discrepancies 3) Description of required corrective action 4) Estimated time to complete corrective action and re-test 5) Results of any corrective action
Completion Notice	Provide to the Engineer after all devices have successfully passed the Local Field Operations Tests, at least five business days before beginning acceptance tests.	Consists of the certification that all ATMS installations are compliant with all project requirements. Use the Local Field Operations Testing Completion Notification Form obtained from the UDOT website.
Compliance Certificate	Submit within five business days of receipt from the Manufacturer for each site.	Provide an installation compliance certification from the manufacturer on required equipment.

Name	Timeline	Description
Manufacturer's Equipment Documentation	Must be received and accepted before Final Acceptance	Submit all factory issued manuals (per this Section), software, detailed shop drawings, wiring diagrams, certifications, warranties, instruction sheets, and part lists for all contractor furnished items to the engineer.
As-Built Drawings	Must be received and accepted before Final Acceptance	Refer to Section 01721

- B. Factory Issued Manuals
 - 1. Acceptable factory manuals must contain technical, diagnostic, and maintenance (preventative and troubleshooting) information. Advertising brochures and catalog cuts not accepted.

1.6 WARRANTY

- A. Provide warranties of merchantability and fitness for a particular purpose for all furnished equipment, as a whole, each of its components, and the workmanship for the duration of one year from the date of acceptance of the entire project by the Department.
- B. Warranties are not required for State-Furnished equipment.
- C. Take any corrective action necessary during the Warranty Period, within 72 hours of being notified by the Engineer, to restore any identified deficiency caused by defective workmanship or materials. Repair or replace defective items. Notify the Engineer when corrective action has been completed.

PART 2 PRODUCTS

2.1 WIRING

- A. Copper, as specified. National Electrical Code (NEC).
- B. Size as specified. American Wire Gauge (AWG).
- C. Power Conductors:
 - 1. Power source conductors, copper, type RHH, USE, RHW.
- D. Signal Cable:
 - 1. Multi-colored cables, as specified.
 - 2. IMSA 20-1

- E. Ground Wire:
 - 1. Solid, bare, soft-drawn, copper wire, as specified.
 - 2. NEC 250.1.
- F. Splice Sealing: Rural Electrical Association (REA) Bulletin 345-72.
 - 1. Use approved direct buried, rigid body splice kits with reenterable, gel-filled encapsulant and listed in the USDA Rural Utilities Service (RUS) List of Materials, Informational Bulletin (IP) 344-2, Section 2 - Housings, Splice Cases, etc. Properly size for the cable or wire being spliced.
 - 2. ASTM D 3005, Type I or II. UL 510.
- G. Detector Cables as specified in Section 13591.

PART 3 EXECUTION

3.1 TESTING AND ACCEPTANCE

- A. The following tests will be required for all appropriate ATMS devices:
 - 1. Cable and Conductor Test
 - 2. Local Field Operations Test
 - 3. Acceptance Tests
 - 4. Remote Operations Test where communication is established or available.
- B. Notify the Engineer at least five working days before the proposed date and time of all tests.
 - 1. Obtain UDOT's newest version (at time of bid) of the ATMS Testing Prenotification Form from the UDOT Web site. Refer to <http://www.udot.utah.gov/index.php/m=c/tid=719>.
 - 2. The Engineer or the Engineer's Agent must witness the tests.
- C. Before any connections are made, perform the Cable and Conductor Test.
 - 1. Obtain UDOT's newest version of the ATMS Cable and Conductor Test Form from the UDOT Web site. Refer to <http://www.udot.utah.gov/index.php/m=c/tid=719>.
 - 2. Before any testing, verify that all cables and conductors are installed as per the manufacturer's plans and recommendations.
 - 3. Perform all resistance testing after final termination and cable installation, but before the connection of any electronics or field devices.
 - 4. Replace the cable, then retest new cable as specified above should any cable fail to meet these parameters, or should any testing reveal defects in the cable.

- 5. Furnish all equipment, appliances, and labor necessary to test the installed cable and conductors.
- D. Refer to the appropriate Standard Specification, Supplemental Specification, or Special Provision for device specific Field Operations Test procedures.
- E. Refer to Section 13595 for acceptance testing procedures.

3.2 EXISTING FACILITIES

- A. Until Final Acceptance, repair any damage to traffic signal equipment, lighting equipment, utilities, and other ATMS items (e.g., conduit, junction boxes, underground traffic signal circuits, cabinets, poles, power sources, or power conductors) caused by contract activities, third party activities, or failure to maintain adequate traffic control or protection of the work.
 - 1. Request a meeting with the Department and the party with current maintenance responsibility to verify that all existing equipment is in working order at the work site.
 - 2. Test all loops, cabling, connectors, cabinet operations, etc.
 - 3. Request, coordinate, and conduct the on-site meeting and provide all labor, materials, test equipment, and test documentation.
 - 4. Complete all testing as non-destructive.
 - 5. If no pre-testing is performed, replace or repair any equipment that is not functioning at the time the work is completed at no additional cost to the Department.
- B. Locate and mark all utilities before beginning construction.
 - 1. Contact Blue Stakes and schedule the locating of underground utilities.
 - 2. Contact any utilities and local government agencies not participating in Blue Stakes locate services.
 - 3. Determine the exact location of all existing utilities by verifying markings with potholing before commencing work, and be fully responsible for any damage that might result from failure to locate and preserve any underground, surface, and overhead utilities.
- C. Contact the Engineer for inspection before restoring cover to any underground facilities repaired during contract execution.
- D. Identify any conflicts with existing facilities and contact the Engineer to re-locate any project foundations, trenches, or other items, before further construction work.
- E. Notify utilities for verification of working clearances and arrange to have a utility company inspector on site if necessary.

- F. Place electrical service requests and orders and coordinate with all other necessary utilities without delaying the project.
- G. Identify and resolve any conflicts with existing utilities at locations pre-marked in the field by the Designer.
- H. Determine right-of-way boundaries before starting work. Do not proceed on work occurring outside Department right-of-way until the required permits, environmental clearances, and approvals are obtained from all entities.
- I. Do not cut any limited access fences.
- J. Perform all digging using hand tools or suction if any construction is to take place within two feet of existing facilities.

3.3 LOCATION OF INSTALLED MATERIALS

- A. Modify proposed equipment locations to avoid conflict with underground utilities or other obstructions as required. Consult Engineer for approval.
- B. Coordinate with the Engineer to have the Engineer or the Engineer's Agent on-site to field locate all new facilities, e.g., cabinet foundations, camera poles, detector poles, and junction boxes.
- C. Field locate equipment with the Engineer.
 - 1. Avoid areas with poor drainage, and place for minimum impact from thrown snow.
 - 2. Place for maximum accessibility and safety for maintenance personnel.
 - 3. Satisfy clear zone requirements as defined in the AASHTO Roadside Design Guide (current edition), Chapters 3 and 4.
- D. Minimum distance behind concrete barrier or guardrail for all above ground equipment: 3 ft.

3.4 EXCAVATION

- A. Do not damage streets, sidewalks, landscaping, or other surrounding features.
- B. Do not excavate wider than necessary for the proper construction of the foundations and other equipment.
- C. Place the material from the excavation in a position that will minimize obstructions to pedestrian or vehicular traffic and interference with surface drainage.

- D. Remove all surplus excavated material and properly dispose of it within 48 hours as directed by the Engineer.
- E. Do not cover any underground materials or equipment fill under any circumstances, until inspected and approved by the Engineer.
- F. Protect pedestrian and vehicular traffic from all excavations.

3.5 ANCHOR BOLTS

- A. Place and hold anchor bolts in proper alignment, position, and height during the placing and vibrating of concrete.
- B. Conform to minimum requirements of AASHTO M 314 for anchor bolts. Do not weld anchor bolts to reinforcing steel. Galvanize all nuts, washers, and anchor bolts in accordance with AASHTO M 232.
- C. Install anchor bolts in accordance with the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals (current edition) Article 5.17. Retighten all nuts after the structure is fully loaded.

3.6 TRAFFIC CONTROL

- A. Refer to Section 01554.
- B. Contact each business manager 48 hours before construction impacts any business access. Place business access signs (consistent with the current MUTCD) where access to the business is not readily apparent anytime an access is closed.

3.7 TEMPORARY TRAFFIC SIGNAL TIMING

- A. Notify the Engineer and the Traffic Signal Coordination Engineer for approval before implementing temporary changes.

3.8 REUSE OF EXISTING CONDUIT AND JUNCTION BOXES

- A. Reuse existing conduit (in-place) and junction boxes when NEC requirements and Department standards for conduit material and depth of cover can be met as specified by the Engineer.

3.9 ABANDON ATMS FACILITIES IN PLACE

- A. Do not remove existing pull wire from conduit that is to be abandoned in place.
- B. Obliterate all existing foundations left in place to a depth of at least 6 inches below the existing surface. Properly dispose of removed concrete.
- C. Remove all conductors, except pull wires, being taken out of service. Cut the ends even with the end of pipe if abandoning in place.

3.10 REMOVE AND SALVAGE ATMS EQUIPMENT

- A. Remove existing equipment as specified.
 - 1. Maintain the integrity of the equipment during removal and transport.
 - a. Contact the Engineer 48 hours before removal to arrange for Department inspection to verify Equipment condition, otherwise the equipment will be assumed functional and undamaged.
 - b. Replace damaged equipment at no additional cost to the Department.
 - 2. Return equipment to the appropriate Department facility as indicated by the Engineer.
- B. All salvageable poles and cabinets:
 - 1. Contact the Engineer at least 48 hours before removal.
 - 2. Return to appropriate Department facility.
- C. Cable and wiring:
 - 1. Spool all cable to be salvaged neatly onto appropriately sized spools.
 - 2. Avoid cutting long cables whenever possible.
 - 3. Cut cables only at splice locations or as directed by the Engineer.
 - 4. Cap wires as described in this Section, article 3.13.
 - 5. Do not exceed the minimum bending radius and the maximum pulling tension recommended by the manufacturer's specifications at any time.

3.11 ELECTRICAL

- A. Perform all work in accordance with the National Electrical Code (NEC), National Electrical Safety Code (NESC), and International Building Code (IBC).

3.12 INSTALL WIRING

- A. Conductors:
 - 1. Clean and dry the inside of the conduit before installing conductors.
 - 2. Install grounding conductor in all power circuit conduits (Refer to NEC, Article 250.1).
 - 3. Use NEC approved lubricants when pulling conductors in conduit.
 - 4. Tape and seal the ends of unused conductors and label them as spares.
 - 5. Use conductors that are color coded as specified in IMSA and comply with NEC, Article 310.
- B. Ground wire:
 - 1. Ground wire in non-metallic conduit must run continuously and be grounded at each junction box, except in those conduits used solely for interconnect and detector circuits.
 - 2. Bond the ground wire to the ground rod in each junction box.
- C. Neatly arrange and support wiring within cabinets, junction boxes, fixtures, etc.
- D. Wire splicing:
 - 1. Splice wires only in detection circuits where the wire type changes in the junction boxes.
 - 2. Mechanically secure and solder, individually insulate, and water seal all splices.
- E. Do not exceed the minimum bending radius or the maximum pulling tension recommended by the manufacturer's specifications at any time.
- F. Keep cable ends sealed at all times during installation using an approved cable end cap. Do not use tape to seal the cable end. Keep cable end sealed until connectors are installed.

3.13 MAINTENANCE OR REPAIR

- A. Repair, replace, maintain and operate all installed ATMS devices until Final Acceptance. Includes but is not limited to:
 - 1. Replacement of damaged cabling.
 - 2. Repair or replacement of damaged conduit and junction boxes.
 - 3. Repair or replacement of Department and Contractor furnished items.
- B. Repair installation or replace equipment due to any damage as specified in Section 00725.

- C. Emergency Maintenance: Until Final Acceptance of the ATMS device, provide emergency maintenance on a seven-day per week, twenty-four hour basis. Respond to the dispatcher within 15 minutes when called or paged by the dispatcher. Provide contacts and telephone numbers to the Engineer for the emergency service.
- D. Limit emergency repair response (one hour maximum) to problems of a public safety nature, such as exposed wires or knockdowns.
- E. Non-emergency repairs: Initiate other non-emergency repairs within 24 hours of notice.
- F. Failure to provide adequate routine or emergency repairs will result in the Department itself making the necessary repairs, or through a separate contractor. The Contractor will be charged accordingly.

END OF SECTION

**Supplemental Specification
2005 Standard Specification Book**

SECTION 13552M

RAMP METER SIGNALS AND SIGNING

Delete Article 1.1 paragraph A and replace with the following:

- A. Materials and procedures for installing conduit, junction boxes, signal heads, signing, mounting brackets, wire, grounding, and foundations. Install all state furnished items. Includes all materials, labor, workmanship, equipment, testing, documentation, and incidental items required to install and test a complete and operational Ramp Meter system as shown in the contract.

Delete Article 1.3 and replace with the following:

- A. AASHTO Standard Specifications for Highway Bridges
- B. AASHTO Standard Specifications for Highway Bridges: Division II - Construction, Section 5: Drilled Piles and Shafts
- C. AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals (current edition)
- D. American Iron and Steel Institute (AISI)
- E. American National Standards Institute (ANSI)
- F. Manual on Uniform Traffic Control Devices (MUTCD)
- G. National Electrical Code (NEC)
- H. Underwriters Laboratories (UL)

Delete Article 1.4 and replace with the following:

1.4 SUBMITTALS

- A. Provide samples of materials to the Engineer for approval when requested.

- B. Provide all of the following submittals as described in Section 13551:
 - 1. Contractor Furnished Material and Equipment Lists
 - 2. Test Reports for the Cable & Conductor Test, the Local Field Operations Test, and the 30 Day Burn-In Test
 - 3. Completion Notice
 - 4. Compliance Certificate
 - 5. Manufacturer's Equipment Documentation
 - 6. As-Built Drawings

Delete Article 2.2 and replace with the following:

2.2 RAMP METER POLE MOUNT SIGNAL ASSEMBLY

- A. One 8-inch section signal head with red LED Module for enforcement. No back plate required.
- B. All signal heads: Refer to Section 02892. Louvered back plate required.
- C. Regulatory Sign: MUTCD R10-6; 24-inch x 36-inch.
- D. "1 Vehicle Per Green" and "2 Vehicles Per Green" Signs: 24 inch x 18 inch. Refer to AT Series Standard Drawings.
- E. All signal head housings: Highway Yellow with hoods.
- F. Signal Pole: Refer to Section 02892 and SL Series Standard Drawings.
- G. Two "Z" bars on the back of the sign to support against thrown snow. Refer to SN Series Standard Drawings.

Delete Article 2.3 and replace with the following:

2.3 RAMP METER MAST ARM SIGNAL ASSEMBLY

- A. All 12-inch signal heads: Refer to Section 02892. Louvered back plate required.
- B. "1 Vehicle Per Green Each Lane" and "2 Vehicles Per Green Each Lane" Signs: 60 inch x 36 inch. Refer to AT Series Standard Drawings.
- C. All signal head housings: Highway Yellow with hoods.
- D. Signal Pole: Refer to SL Series Standard Drawings.

Delete Article 2.4 and replace with the following:

2.4 ADVANCE FLASHING BEACON SIGN

- A. Two 8-inch signal heads with yellow LED Module: Refer to Section 02892. No back plate required.
- B. Warning Sign: WS3-3, 36-inch x 36-inch. Refer to AT Series Standard Drawings.
- C. “Metering When Flashing” Sign: 30-inch x 24-inch black on yellow. Refer to AT Series Standard Drawings.
- D. All signal head housings: Highway Yellow with hoods.
- E. Signal Pole: Refer to Section 02892 and SL Series Standard Drawings.
- F. Two “Z” bars on the back of the sign to support against thrown snow. Refer to SN Series Standard Drawings.

Delete Article 2.5 and replace with the following:

2.5 BOLTS AND NUTS

- A. Follow Section 02892.
- B. Follow Section 13551 for Anchor Bolts.

Delete Article 2.6 and replace with the following:

2.6 WIRE

- A. Follow Section 02892 for signal cable specifications.

Delete Article 2.7 paragraph B.

Add the following to Article 2.8:

- C. Use 240-volt 400 watt luminaires.

Delete Article 3.1 paragraph A and replace with the following:

- A. Load, transport, and install all state-furnished materials per the manufacturer’s instructions and as shown in the contract.

Delete Article 3.1 paragraph C and replace with the following:

- C. Install all wiring, conduit, and junction boxes as shown in the contract.
 - 1. Field locate all conduit and junction boxes to avoid drainage areas and steep slopes whenever possible.
 - 2. Protect existing conductors while installing new conductors.

Delete Article 3.1 paragraph F and replace with the following:

- F. Clean equipment exterior of all rust and mill scale, dirt, oil, grease and other foreign substances after installation.

Delete Article 3.2 and replace with the following:

3.2 FOUNDATION

- A. Conform to AASHTO Standard Specifications for Highway Bridges for all material and workmanship.
- B. Verify that the installation locations of the signal heads, mast arm, pole, and foundation have no conflict with existing utilities before work. Comply with all utility and Blue Stakes requirements.
- C. See AT Series Standard Drawings for ramp meter signal assembly and advance flashing beacon assembly details and placement.
- D. Excavate for foundations. Refer to Section 13551.
- E. Construct caissons to conform to AASHTO Standard Specifications for Highway Bridges: Division II - Construction, Section 5: Drilled Piles and Shafts. If formwork is required during drilling, the forms may be withdrawn during concrete placement.
 - 1. Drill caissons into either native soil or compacted fill.
 - 2. Cast the top of the caisson against the formwork for appearance.
- F. Place concrete directly into the excavation. Use minimum forming.
- G. Tie reinforcing steel and conduit securely in place. Do not weld reinforcing steel, conduit, or anchor bolts.
- H. Install reinforcing steel according to Section 03211.
- I. Cap all conduits before placing concrete.

- J. Install weep hole in foundation per SL Series Standard Drawings.

Delete Article 3.4 paragraph C and replace with the following:

- C. Install ground rod per contract (NEC 250).

Delete Article 3.8 paragraphs B through E and replace with the following:

- B. Install directed and veiled optically programmed signals following the manufacturer's instructions. Mask each section of the signal with manufacturer recommended materials.
- C. Use louvered back plates on those signal heads indicated. Use a minimum of four 0.12-inch stainless steel screws per section to mount the back plates, or according to manufacturer's instructions.
- D. Install ramp meter signal head toward vehicles approaching the intersection stop-bar. Side Signal Head: axis or indication parallel to roadway surface.

Delete Article 3.9 paragraphs B and C and replace with the following:

- B. Refer to AT Series Standard Drawings for location of Presence and Discharge Loop.
- C. Consult the Engineer for saw cut loops.

Delete Article 3.11 paragraph B and replace with the following:

- B. Perform the Local Field Operations Test after all ramp meter elements, equipment and hardware, power supply, detection device (Refer to Section 13591) and connecting cabling have been installed.
 - 1. Complete the Local Field Operations Test for Ramp Meters using the required form. Obtain UDOT's newest version at time of bid of the form from the UDOT Web site. Refer to <http://www.udot.utah.gov/index.php/m=c/tid=719>.
 - 2. Perform testing after all construction for the site has been completed and the final road surface has been constructed.
 - a. It is not necessary for the communications installation to be completed at the time of testing.
 - b. It is not necessary that all stations be tested concurrently.

**Supplemental Specification
2005 Standard Specification Book**

SECTION 13553

ATMS CONDUIT

Delete Section 13553 and replace with the following:

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Materials and procedures for installing conduit as specified in the contract. Unless otherwise specified, install conduit by trenching, boring, or plowing.
- B. Detectable pull tape and all materials, labor, workmanship, equipment, and incidental items required for a complete system of conduit.

1.2 RELATED SECTIONS

- A. Section 00725: Scope of Work
- B. Section 01721: Survey
- C. Section 02061: Select Aggregate
- D. Section 02324: Compaction
- E. Section 02705: Pavement Cutting
- F. Section 02741: Hot Mix Asphalt (HMA)
- G. Section 02776: Concrete Sidewalk, Median Filler, and Flatwork
- H. Section 02892: Traffic Signal
- I. Section 03575: Flowable Fill
- J. Section 13554: Polymer Concrete Junction Box

1.3 REFERENCES

- A. ASTM D 2241: Standard Specification for Poly-Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)
- B. American National Standards Institute (ANSI)
- C. National Electrical Code (NEC)
- D. National Electrical Manufacturers Association (NEMA)
- E. Railroad Specifications
- F. Underwriters Laboratory (UL)

PART 2 PRODUCTS

2.1 MATERIALS

- A. Conduit and Fittings:
 - 1. Schedule 40 PVC rated at 194 degrees F, as specified. NEMA TC-2, NEMA TC-3, ASTM D 2241, UL Listed
 - 2. HDPE (High Density Polyethylene) SDR11 rated, as specified. ASTM D 2241
 - 3. Rigid steel as specified (UL-6)
 - 4. Galvanized as specified (ANSI C80.1)
- B. Non-Metallic Conduit
 - 1. New, prefabricated.
 - 2. ATMS Multi-duct Conduit Types
 - a. 1D = four 2-inch conduits
 - b. 2D = eight 2-inch conduits
 - c. 4D = sixteen 2-inch conduits
 - 3. Color-code each conduit or cell as follows:
 - a. One, two or three conduits: gray
 - b. 1D
 - Bank 1: blue, orange, green and brown
 - c. 2D
 - Bank 1: blue, orange, green, and brown
 - Bank 2: slate, white, red, and black

- d. 4D
 - Bank 1: blue, orange, green, and brown
 - Bank 2: slate, white, red, and black
 - Bank 3: same as bank 1 with a stripe of contrasting color
 - Bank 4: same as bank 2 with a stripe of contrasting color
- C. Meet or exceed all of the conduit manufacturer's recommendations for all materials used in the installation of conduits, such as sweeps, adapters, couplings, glue, plugs, and fittings. Conduit plugs must seal the conduit and allow the secure fastening of detectable pull tape.
- D. PVC conduit sections: nominal 20 ft sections; couplings and fittings to provide for watertight integrity.
- E. Sweeps: conduit manufactured sweeps (11¼, 22½, 45, and 90 degree angles) complete with bell and spigot.
- F. Pull Tape: flat profile, low stretch polyester, detectable, sequential footage marked, 1,200 lb tensile strength pull tape in each empty conduit.
- G. Fiber optic and electrical buried cable marker warning tape:
 - 1. Material: Composite reinforced thermoplastic.
 - 2. Tape Color: Orange (communication) or Red (electric).
 - 3. Text: Caution Buried Communication Cable or Caution Buried Electric (front and back).
 - 4. Maximum distance between text: 5 feet.
 - 5. Text Color: Black.
 - 6. Width: 3-inch minimum (face or diameter).
- H. Backfill
 - 1. Flowable Fill: Refer to Section 03575.
 - 2. Free Draining Granular Backfill Borrow: Refer to Section 02061.
 - 3. Native material: Compact per Section 02324.
- I. Submit all material certifications to the Engineer for approval.

PART 3 EXECUTION

3.1 GENERAL

- A. Base final conduit routing on actual field conditions at the time of construction, including Blue Stake markings, to prevent conflicts with existing utilities.
- B. Do not place conduit directly above parallel utilities.
- C. Obtain appropriate permits before work commences.
- D. Record longitudinal and depth GPS coordinates (x,y,z) of conduit according to Section 01721 and show on as-built drawings.
- E. Bore conduit when crossing all roadways.
- F. Install conduit under park strip where curb and gutter is present.
- G. Maximum spacing between junction boxes is as follows:
 - 1. 1,000 ft for tangent surface street installations
 - 2. 2,500 ft for tangent highway installations
 - 3. Reduce maximum spacing if horizontal or vertical deflection prevents the installation of cable within maximum tensile rating of the cable.
- H. Conduit under Railroad Right-of-Way: Refer to Section 00725 and appropriate railroad specifications, such as Union Pacific Railroad, Standard Specifications:
 - 1. Coordinate all work with appropriate Railroad personnel.
 - 2. Complete Railroad Safety Training.
- I. Minimum Cover of Conduit:
 - 1. Minimum cover in sidewalks or paved surfaces: 3 ft.
 - 2. Minimum cover in highway right-of-way, greater than 20 ft from the edge of the pavement: 3 ft.
 - 3. Minimum cover in highway right-of-way, within 20 ft of the edge of the pavement: 5 ft.
- J. The Department will not grant additional time or money for installing conduit in difficult subsurface conditions.
- K. Obtain approval from the Department on conduit splice connectors before use.

3.2 INSTALLATION

- A. Do not allow conduit to deflect vertically or horizontally along its length by a ratio greater than 10:1, (e.g. no more than 4-inch deflection per 40 inch in length) when installing conduit that houses communication cable.
- B. Do not allow the sum total of the vertical and horizontal deflection of conduit and bends between any two junction boxes to exceed 270 degrees when installing conduit.
- C. Locate conduit within 1 ft of existing parallel conduit run if the planned location of conduit is parallel to the existing traffic signal or ATMS conduit. Refer to Section 02892.
- D. Do not field bend conduit. Install all conduit bends to have a radius that is not less than the following:
 - 1. 24 inches within the cabinet and pole foundations
 - 2. 36 inches in all other locations
- E. Install conduits that cross finished curbs and gutters, sidewalks, concrete flatwork, textured or decorative surfaces by boring, jacking, or drilling. Replace entirely any damaged concrete sections, joint to joint, at no additional cost to the Department.
- F. Conduit Stub:
 - 1. Install conduit in a junction box per Section 13554 to allow for the continuation of a conduit run. Type and number of conduits as specified in the contract.
 - 2. Extend conduit stub to 10 feet from the junction box in line with the conduit run as specified in the contract.
- G. Proof all conduits with an approved mandrel before installation of cabling and detectable pull tape.
- H. Provide detectable pull tape in all empty conduits.
 - 1. Install continuously between junction boxes.
 - 2. Fasten securely to plug and leave 3 ft of pull tape slack inside of the conduit.
 - 3. Do not splice detectable pull tape in conduit.
- I. Place all conduit that is encased in a structural member per current International Building Code and as approved by the Engineer.

- J. Secure conduit on concrete structures with standard galvanized steel conduit clamps using an approved anchoring system.
 - 1. Install per manufacturer's requirements.
 - 2. Use waterproof conduit expansion fittings at structure expansion joint crossings.
- K. Fill all new and existing conduit to a maximum of 40 percent as per NEC.
- L. Encase all open trench conduit in flowable fill. Encase plowed and bored conduit in flowable fill at exposed locations, conduit splice points, and junction box connections.
- M. Use galvanized rigid steel conduit for above ground application; use PVC or HDPE conduit for underground application. Apply corrosion protection per NEC Article 346 to any portion of galvanized rigid steel conduit buried in the ground or encased in concrete.
- N. Warning Tape:
 - 1. Install orange warning tape with black legend "Caution - Buried Communication Cable", in all trenches containing multi-duct conduit or conduit containing communication cables.
 - 2. Install red warning tape with black legend "Caution - Buried Electric" in all other trenches.
 - 3. Not required when flowable fill is directly overlaid with asphalt pavement or PCCP.
 - 4. Not required when boring conduit.
- O. Install a bushing or adapter at ends of all nonmetallic conduit that contains a conductor per NEC Article 346. Install rounded bushings on the ends of metal conduit per NEC Article 347.
- P. Install manufactured sweeps (11¼, 22½, 45, and 90 degree angle) with conduit compatible bell and spigot ends.

3.3 TRENCH

- A. Paved Surface (asphalt concrete):
 - 1. Install T-patch over trenched area according to AT Series Standard Drawings.
 - 2. Cut pavement from roadway surface to roadway base on both sides of trench to provide a clean, straight wall for T-patch, before any backhoe use per Section 02705.
 - 3. Refer to AT Series Standard Drawings for depth of flowable fill under paved surfaces.
 - 4. Compact soil under pavement per Section 02324.

5. Evenly apply tack coat on final backfill before installing T-patch.
 6. Restoration patch: match the composition, density, and elevation ($\pm\frac{1}{4}$ inch), of the existing surface per Section 02741.
 7. Apply a hot-pour rubberized asphalt joint sealant or approved equal after the patch is installed.
- B. Sidewalk or Decorative Pavement.
1. Use flowable fill to bottom of new pavement.
 2. Match existing pavement thickness, but new pavement thickness must be $3\frac{1}{2}$ inches minimum, 8 inches maximum.
 3. Compact soil under pavement per Section 02324.
 4. Restore sidewalk or decorative pavement to original condition or better after work is completed per Section 02776.
- C. Unpaved Surface:
1. Use backfill that matches the composition, density, and elevation (± 0.2 inch), of the existing surface per Section 02776.
 2. Dispose of surplus material daily.
 3. Use flowable fill from bottom of trench to 3 inches above top conduit.
- D. Sleeve foreign utilities that cross a trench so they are not encased in flowable fill.
- E. Place all conduits in the same trench whenever possible.
- F. Flowable fill:
1. Encapsulate conduit at least 3 inches above the top conduit with flowable fill.
 2. Continue flowable fill to the wall of the junction box to seal conduit entry into the junction box.
 3. Clean excess flowable fill from the inside of the junction box.
- G. Install all conduits so the flowable fill completely surrounds all exterior surfaces of the conduit. Separate multi-duct conduits using a commercially available conduit spacer or approved equivalent.
- H. Anchor the conduit in trench at 16 ft intervals to maintain the required conduit depth during flowable fill placement.
- I. Minimum separation between all conduit and the wall of the trench is $1\frac{1}{2}$ inches.
- J. In native earth, do not place flowable fill within 8 inches of the finished grade.

3.4 BORE OR PLOW

- A. Install flowable fill per this Section, article 3.3, at all exposed conduit locations.
- B. Immediately contain and remove all drilling fluid outside the bore. Contractor's estimate will not be processed until all drilling fluid outside the bore has been removed and properly disposed.

3.5 USE OF EXISTING OR OCCUPIED CONDUIT

- A. Maintain the physical condition and functional integrity of all cabling and wiring in existing or occupied conduit.
- B. For installation of cable or wire in an existing or occupied conduit:
 - 1. Remove any existing fiber optic cable or copper wire.
 - 2. Test the integrity and clean the conduit by successfully pulling a Department approved mandrel through the conduit.
 - 3. Re-pull existing and new fiber optic cable or copper wire together.
 - 4. Perform all necessary splices and replace any impacted fiber cable and spider fan-out kits.
 - 5. Perform all additional work necessary to restore existing cable and conduit systems to original or better condition.
- C. Use existing conduit only in-situ and as approved by the Engineer or as specified in the contract.
- D. Use new conduit on all new installations.

3.6 REPAIR OR RESTORATION

- A. Restore all areas, including landscaping, concrete pavement, asphalt, finished curbs and gutters, box culverts, sewers, underground water mains, sprinkler systems, sidewalks, concrete flatwork, and textured or decorative surfaces damaged during conduit and junction box installation.
- B. Coordinate with local utilities for utility repair.
- C. Notify the Engineer of all necessary repairs.

END OF SECTION

**Supplemental Specification
2005 Standard Specification Book**

SECTION 13554

POLYMER CONCRETE JUNCTION BOX

Delete Section 13554 and replace with the following:

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Materials and procedures for installing polymer concrete junction boxes, ground rods, and maintenance markers. Includes Type I, Type II, and Type III Polymer-Concrete Junction Boxes.

1.2 RELATED SECTIONS

- A. Section 01721: Survey
- B. Section 02056: Common Fill
- C. Section 02061: Select Aggregate
- D. Section 02842: Delineators
- E. Section 02892: Traffic Signal
- F. Section 03055: Portland Cement Concrete
- G. Section 03152: Concrete Joint Control
- H. Section 03575: Flowable Fill
- I. Section 13551: General ATMS Requirements
- J. Section 13553: ATMS Conduit

1.3 REFERENCES

- A. ASTM C 109: Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch or 50 mm cubes)
- B. ASTM C 496: Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens
- C. ASTM C 579: Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
- D. ASTM C 580: Standard Test Methods for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
- E. ASTM C 857: Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
- F. ASTM C 1028: Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull Meter Method
- G. ASTM D 543: Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents
- H. ASTM D 570: Standard Test Method for Water Absorption of Plastics
- I. ASTM D 635: Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastic in a Horizontal Position
- J. ASTM G 154: Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials
- K. American National Standards Institute (ANSI)
- L. Underwriters Laboratory (UL)

PART 2 PRODUCTS

2.1 FILL

- A. Free draining granular backfill borrow per Section 02061.
- B. Granular backfill borrow per Section 02056.
- C. Flowable fill per Section 03575.

2.2 JUNCTION BOXES AND LIDS

- A. Junction boxes: pre-cast polymer concrete. Refer to AT Series Standard Drawings for dimensions of junction box types.
- B. Furnish boxes, rings, and lids that sustain a minimum vertical test load of 33,500 lbs (AASHTO HS 20 loading) as a stand-alone unit, over a 10-inch x 20-inch square steel plate centered on the cover and body as per ASTM C 857-95 design load A-16.
- C. Furnish boxes, rings, and lids that meet the physical and chemical requirements listed in Table 1:

Table 1

Physical and Chemical Properties of Junction Box Components		
Property	ASTM Test	Value
Compressive Strength	C 109	11,000 psi
Flexural Strength	C 580	1,800 psi
Tensile Strength	C 496	1,700 psi
Effects of Acids	D 543	Very Resistant
Effects of Alkalies	D 543	Very Resistant

- D. Furnish junction boxes that are tested according to the following ASTM testing procedures. Provide results upon request.
 - 1. Ultraviolet Inhibitors: ASTM G 154
 - 2. Flame-Resistance: ASTM D 635
 - 3. Water Absorption Resistance: ASTM D 570
- E. Furnish lids that have a non-skid surface for pedestrian traffic with a minimum coefficient of friction of 0.50 per ASTM C 1028 without the use of coatings.

- F. Lids for all junction boxes are specified by application. Manufacture lids with the following markings in the logo area, in 1-inch recessed letters:
1. "Traffic Signal" when the junction box contains cables or wires for a traffic signal (Refer to Section 02892), CCTV, VMS, RWIS, WIM, ramp meter, traffic monitoring, or any other ATMS element (Refer to Section 13551).
 2. "Electric" when the junction box contains power conductors used for a traffic signal, CCTV, VMS, RWIS, WIM, ramp meter, traffic monitoring, or any other ATMS element.
 3. "Street Lighting" when the junction box contains street lighting conductors only. Inscribe "High Voltage" below the words "Street Lighting" when the junction box contains voltage above 600 V.
 4. "Communication" when the junction box contains fiber optic cable or future use multi-duct conduit.
 5. "Sprinkler Control" when the junction box contains sprinkler control conduit.
- G. Lid Access Points: recessed reinforced steel pull slots to allow removal of cover with a hook or lever. Replace lid if damage occurs to the pulling point.
- H. Bolts: stainless steel recessed hex head bolts with washer according to AT Series Standard Drawings.

2.3 MAINTENANCE MARKERS

- A. Fiber Glass posts: Orange, 4 inch wide by 4 ft tall, labeled "UDOT Fiber Optics." Refer to Section 02842.

2.4 CONDUIT PLUGS

- A. Refer to Section 13553.

2.5 GROUND ROD

- A. 8 ft x $\frac{5}{8}$ inch copper-coated steel ground rod as specified by ANSI/UL 467

2.6 WIRING

- A. Ground Wire: Refer to Section 13551.

2.7 CONCRETE COLLAR

- A. Class AA(AE) concrete. Refer to Section 03055.

2.8 EXPANSION JOINT MATERIAL

- A. Expansion joint material. Refer to AT Series Standard Drawings and Section 03152.

2.9 PULL TAPE

- A. Pull Tape: Refer to Section 13553.

2.10 LOCATE BALL OR DISK

- A. Greenlee Omni Marker or approved equal.

PART 3 EXECUTION

3.1 BACKFILL

- A. Place 12 inches of free draining granular backfill borrow under junction boxes.
- B. Hand tamp granular backfill borrow or approved native soil around the junction box collar. Match the top 8 inches to the composition, density, and elevation of the surrounding surface.

3.2 JUNCTION BOX AND EXTENSION

- A. Install per manufacturer's recommendations.
- B. Precast junction boxes with precast conduit holes or drill holes to match conduit entry where required without damaging the box. Use grout to create a complete seal between conduit and the structure wall. Finish grout smooth and flush with the interior wall.
 - 1. Holes drilled in junction box must not be more than ¼-inch larger than conduit diameter.
 - 2. Seal conduit ends inside all junction boxes with at least 2-inch thick duct caulking after wires are installed.
 - 3. Seal vacant conduit with a manufactured conduit plug and attach detectable pull tape according to Section 13553.
- C. Level the top of junction box and grade accordingly.

- D. Field-locate junction boxes to avoid steep slopes and low lying locations with poor drainage.
- E. Do not install junction boxes within the traveled way or shoulders.
- F. Install bushings on end of all metallic conduits before cable installation.
- G. Conduit in junction box:
 - 1. Do not install conduit within 2 inches of corner of junction box.
 - 2. Extend all conduit 2 to 6 inches beyond the inside wall of the junction box.
 - 3. Align ATMS conduit ends by color at each side of the box.
 - 4. Enter conduit through the sides of the junction box and not from the bottom.
 - 5. Place the conduit in the bottom half of the junction box wall at least 3 inches above the floor.
 - 6. Refer to AT Series Standard Drawings.
- H. Saw cut concrete or other surfaces that require removal in the sidewalk area.
 - 1. Remove entire section of sidewalk.
 - 2. Replace with in-kind materials to match the existing grade.
- I. Install Engineer-approved ½-inch expansion joint material around entire periphery of ring for junction boxes installed in paved surface.
- J. Record GPS coordinates for all junction boxes according to Section 01721 and show on as-built drawings.
- K. Encase all conduit in flowable fill where conduit enters the junction box.
- L. Provide a poured-in-place 1-inch thick grout floor, with a 1-inch diameter drain at the low point, for all Type I, II, and III-Polymer Concrete Junction Boxes or provide a box with a prefabricated floor with a 1-inch drain hole. Grout in accordance with ASTM C 579 and ASTM C 580.
- M. Do not stack boxes.
- N. Provide maintenance markers for junction boxes on freeways and rural highways. Place maintenance markers:
 - 1. A minimum of 20 ft from edge of pavement if junction boxes are within 20 ft of edge of pavement.
 - 2. At right-of-way where junction box is within 20 ft of right-of-way.
 - 3. Within 2 ft of junction box at all other locations.

3.3 CONCRETE COLLAR

- A. See AT Series Standard Drawings.
- B. Concrete: AA(AE) Refer to Section 03055.
- C. Install concrete collars around junction boxes in all locations except where junction boxes are in concrete paved surfaces.
- D. Secure ½-inch expansion joint material around the junction box before placing concrete collar.

3.4 GROUND ROD

- A. Install ground rod to extend maximum 2 inches above box floor.
- B. Attach splice enclosure to the ground rod with a ground wire.

3.5 LOCATE BALL OR DISK

- A. Place locate ball or disk in each ATMS junction box.

3.6 RESTORATION

- A. Restore all areas damaged during the installation of the junction boxes at no additional cost to the Department.

END OF SECTION

**Supplemental Specification
2005 Standard Specification Book**

SECTION 13555M

ATMS CABINET

Delete Article 1.2 and replace with the following:

1.2 RELATED SECTIONS

- A. Section 02892: Traffic Signal
- B. Section 03055: Portland Cement Concrete
- C. Section 03152: Concrete Joint Control
- D. Section 03211: Reinforcing Steel and Welded Wire.
- E. Section 03310: Structural Concrete
- F. Section 13551: General ATMS Requirements
- G. Section 13553: ATMS Conduit
- H. Section 13554: Polymer Concrete Junction Box
- I. Section 13561: ATMS Power Service

Add Article 1.3 paragraph E:

- E. National Electrical Code (NEC)

Delete Article 2.1 paragraph A and replace with the following:

- A. Concrete: AA(AE) required. Refer to Section 03055.

Delete Article 2.2 paragraph B and replace with the following:

- B. Provide commercially available framing strut to attach transformers, breaker enclosures, disconnects, or other electrical equipment (Refer to AT Series Standard Drawings).
 - 1. 12-gauge, U-shaped stainless steel channel with $\frac{5}{8}$ -inch diameter pre-drilled holes.
 - 2. Cross-section dimensions: $1\frac{5}{8}$ inch x $1\frac{5}{8}$ inch minimum.

Add Article 2.4 paragraph B:

- B. Minimum spacing from any edge of junction box to any edge of concrete collar must be 10 inches.

Delete Article 2.7 and replace with the following:

2.7 EXPANSION JOINT MATERIAL

- A. Preformed expansion joint filler. Refer to AT Series Standard Drawings and Section 03152.

Delete Article 3.1 paragraph C and replace with the following:

- C. Restore area to the original condition after construction is completed.

Delete Article 3.1 paragraph D

Delete Article 3.2 and replace with the following:

3.2 CONSTRUCT CABINET FOUNDATION

- A. Reinforcing Steel and Welded Wire. Refer to Section 03211.
- B. Verify bolt pattern, conduit runs, and foundation dimensions before foundation construction.
 - 1. Install anchor bolts to accommodate conduit runs.
 - 2. Embed strut anchor bolts a minimum of 6 inches into foundation.
 - 3. Embed cabinet anchor bolts a minimum of 6 inches into foundation.
- C. Concrete: Refer to Section 03055.

- D. Do not weld reinforcing steel, conduit, or anchor bolts.
 - 1. Use tie wire to secure conduits.
 - 2. Use template to align and secure anchor bolts.
 - 3. Locate steel, conduit, or anchor bolts a minimum of 3 inches from concrete surface.
- E. Place the concrete directly into the excavation. Use minimum forming above ground.
- F. Provide minimum setback between foundation and all walls, guardrails, poles, and other above ground features as per Section 13551.
- G. Extend conduit 2 inches above the floor of the cabinet foundation.
- H. Conduit:
 - 1. Install all conduit in base of cabinet within a 12-inch x 18-inch rectangle centered in the cabinet base.
 - 2. Refer to the contract for the number, size, and orientation of all conduits entering the junction boxes.
 - 3. Refer to AT Series Standard Drawings for number and type of conduit used between the cabinet and adjacent junction boxes.
 - 4. Above ground, use galvanized rigid steel; underground, use PVC.
 - 5. Install bushings on the ends of all conduit before cable installation.
 - 6. Provide 1 inch minimum spacing between each conduit in cabinet base. Cap conduit at both ends until used.
- I. Place the cabinet foundation parallel to the roadway.
- J. Cabinet foundation surfaces:
 - 1. Ordinary Surface Finish per Section 03110
 - 2. Chamfer around top surface perimeter
 - 3. Level top surface before cabinet installation
- K. Place preformed expansion joint filler at concrete joints.

Delete Article 3.3 paragraph E and replace with the following:

- E. Caulk between base of cabinet and top of foundation to form a watertight seal.

Add Article 3.3 paragraph F:

- F. Orient cabinet on foundation with the vented door downstream of traffic.

Delete Article 3.4 and replace with the following:

3.4 INSTALL DISCONNECT, TRANSFORMER, OR BOTH

- A. Install either a supplemental disconnect as described on AT Series Standard Drawings, or an approved underground service pedestal as described in the SL Series Standard Drawings and in Section 13561 unless otherwise specified.
- B. Install disconnect or underground service pedestal between 10 and 15 feet from the cabinet, away from roadway. Field locate with the Engineer.
- C. Ground disconnect on ground rod located in Type I junction box at the cabinet base.
- D. Ground the transformer to the control cabinet ground terminal.
- E. Install disconnect and transformer in accordance with AT Series Standard Drawings, SL Series Standard Drawings, and the NEC.

Delete Article 3.6 paragraphs A and B and replace with the following:

- A. Refer to Section 13561 for Power Service.

**Supplemental Specification
2005 Standard Specification Book**

SECTION 13561

ATMS POWER SERVICE

Delete Section 13561 and replace with the following:

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Materials and procedures for installing a complete electrical power service as shown in the contract. Includes all coordination with the power service provider, wires, surge protection, rigid metal riser, weatherhead, transformer, disconnects, conduit risers and stand-off brackets, breakers, clamps, conduit, junction boxes, grounding materials, duct seal, pull wire, labor, workmanship, equipment, testing, documentation, and incidental items required for a fully operational system.
- B. Materials and procedures for installing a Power Pole.

1.2 RELATED SECTIONS

- A. Section 02324: Compaction
- B. Section 13551: General ATMS Requirements

1.3 REFERENCES

- A. ASTM A 123: Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- B. ASTM B 117: Operating Salt Spray (Fog) Apparatus
- C. Electrical Utility Service Equipment Requirements Committee (EUSERC)
- D. Local utility electric service requirements
- E. National Electrical Manufacturers Association (NEMA) Standards

- F. National Electrical Code (NEC)
- G. Underwriters Laboratories (UL)

1.4 SUBMITTALS

- A. In accordance with Section 13551.

PART 2 PRODUCTS

2.1 GENERAL

- A. Comply with NEC standards, local utility electric service requirements and standards, and Department standards for all electric service products.
- B. Provide approved underground service pedestal. Service Enclosures must be NEMA 3R rated. Refer to NEMA Standards Publication 250-1997.
- C. Use a safety switch as indicated in the contract.
- D. Provide circuit breakers sized as specified in the contract.
- E. Conductors are to be provided as sized and numbered in the contract.
- F. Provide riser and weatherhead in accordance with Department and local utility standards. Refer to SL Series Standard Drawings.
- G. Provide approved blade or breaker disconnects as specified in the contract.
- H. Provide MasterLock P848 Lock (provide two keys per lock to the Engineer), or disposable aluminum lock with break-off screws for all disconnects and service pedestals.
- I. Pole Mount (when approved by the power provider): Refer to SL Series Standard Drawings
 - 1. Service disconnect according to contract.
 - 2. Provide a manual EUSERC approved circuit closing link by-pass release meter socket.
 - 3. Unmetered street lighting circuit.

- J. Underground Service Pedestal: As specified, ASTM B 117, and ASTM A 123 (Cabinet), UL E 50076.
 - 1. Enclosure: 0.120 inch galvanized steel or anodized aluminum
 - a. 0.080 inch galvanized steel or anodized aluminum covers
 - b. Finished surface with an environmental green, baked enamel over zinc-chromate primer as specified, or anodized aluminum: ASTM B 117
 - c. Bottom access opening
 - d. EUSERC approved circuit-closing by-pass release meter socket
 - e. Baffled ventilation louvers
- K. Circuit Breaker: Main Breaker
 - 1. Six space metered
 - 2. Six space unmetered bus
- L. Detachable, pad-mount base.
- M. Use copper conductor with stamped “RHH-USE-RHW” or “XHHW” rated insulation for all underground and riser electrical conductors

2.2 WOOD POWER POLE

- A. Comply with local utility electric service requirements in selecting power pole.

PART 3 EXECUTION

3.1 GENERAL

- A. Comply with NEC standards, local utility electric service requirements and standards, and Department standards for all electric service installations.
- B. Install underground service pedestal.
- C. Coordinate any utility connection with the Engineer and utility company. Contact the Engineer and utility company at least 60 days before the desired connection date.
- D. Verify the exact location, voltage, procedure, and materials required by the utility company.
- E. Ground all electrical equipment, including cabinets, metal structures, in accordance with the NEC standards.

- F. Supply all conduit and conductors to power source connection location. The power company makes the final connection.

3.2 POWER SERVICE

- A. Contact the Engineer at least six weeks before power service hookup to coordinate power service connection and to confirm connection date.
- B. The Department will be responsible for all on-going electrical costs.

3.3 WOOD POWER POLE

- A. Install power pole as specified in the contract and in accordance with all Department and local utility standards. Contact the power company ten days before pole installation.
- B. Install wood pole below grade to a minimum depth equal to one-sixth the total pole height.
- C. Increase the installation depth by one pole diameter (measure depth from the down-slope side of the pole) when wood pole is installed on a slope of 2:1 or greater.
- D. Backfill with native material in 1 ft lifts to match surrounding grade. Tamp each lift to at least 90 percent compaction. Follow Section 02324 requirements for poles placed near structures.

END OF SECTION

**Supplemental Specification
2005 Standard Specification Book**

SECTION 13591M

TRAFFIC MONITORING DETECTOR LOOP

Delete Article 1.3 paragraph B.

Delete Article 3.1 paragraph A and replace with the following:

- A. The number of loops and the number of lanes varies based on location shown in the contract.

Delete Article 3.2 paragraphs D and E and replace with the following:

- D. Minimum distance between saw-cut and transverse joints, or between adjacent lead-in saw cuts: 1½ ft.
- E. Loop Spacing: 21½ ft between leading edges.
Maximum tolerance: 1 inch.

Delete Article 3.2 paragraph G and replace with the following:

- G. Use wet vacuum or appropriate remediation to prevent saw-cutting water and residue from flowing into live traffic lanes.

Delete Article 3.3 paragraph A and replace with the following:

- A. Follow Section 02892.

Delete Article 3.3 paragraphs E and F and replace with the following:

- E. Seal loop wire ends immediately upon installation with waterproof coating, coil neatly, and place in a junction box.
- F. Install Loop Sealant
 1. Fill and encapsulate loop and lead-in wires a minimum depth of 3 inches from the pavement surface.
 2. Install embedding loop sealant in saw cuts allowing $\pm \frac{1}{4}$ inch from the top of the pavement after curing and expansion is complete.
 3. Allow sealant adequate time to cure under ambient environmental conditions before lane is re-opened to traffic.

4. Refer to manufacturer's specifications regarding expansion of sealant during curing period. Refer to Section 02892.

Delete Article 3.3 paragraphs I and J and replace with the following:

- I. Concrete Pavement Exit
 1. Drill 2-inch diameter hole at 45-degree angle 1 ft from concrete edge.
 2. Install conduit originating from splicing junction box to the pavement edge. Extend conduit 3 inches into drilled hole.
 3. Seal conduit after loop wires are installed and fill the hole to within 1½ inches of road surface with silica sand.
 4. Seal remaining hole in the road surface with loop sealant.
- J. Conduit Connection to Junction Box
 1. Seal conduit with waterproof bushings. Refer to Section 13553.
 2. Fill voids resulting from entrance of conduit into junction box with hydraulic cement grout. Refer to Section 13554.

Delete Article 3.3 paragraph L.

Delete Article 3.4 paragraphs A and B and replace with the following:

- A. Perform a Detector Loop Inductance & Resistance Test as described in Section 02892. Obtain UDOT's newest version at time of bid of the Detector Loop Inductance & Resistance Test form from the UDOT Web site. Refer to <http://www.udot.utah.gov/index.php/m=c/tid=719>. Submit Detector Loop Inductance & Resistance Test to the Engineer for acceptance.
- B. Perform the Local Field Operations Test after all Traffic Monitoring Detector Loop elements, equipment and hardware, power supply, and connecting cabling have been installed.
 1. Perform testing after all construction for the site has been completed and the final road surface has been constructed.
 - a. It is not necessary for the communications installation to be completed at the time of testing.
 - b. It is not necessary that all stations be tested concurrently.

**Supplemental Specification
2005 Standard Specification Book**

SECTION 13592

**ROADWAY WEATHER INFORMATION SYSTEM -
ENVIRONMENTAL SENSOR STATION (RWIS-ESS)**

Delete Section 13592 and replace with the following:

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. RWIS Site Preparation
 - 1. Install buried conduit in accordance with industry standards.
 - 2. Install junction boxes with grounding rods, tower foundation, and fencing, as specified in the contract or as directed by a UDOT representative.

1.2 RELATED SECTIONS

- A. Section 02324: Compaction
- B. Section 02330: Embankment
- C. Section 02776: Concrete Sidewalk, Median Filler, and Flatwork
- D. Section 02821: Chain Link Fencing and Gates
- E. Section 03055: Portland Cement Concrete
- F. Section 03211: Reinforcing Steel and Welded Wire
- G. Section 03310: Structural Concrete
- H. Section 13553: ATMS Conduit
- I. Section 13554: Polymer Concrete Junction Box

1.3 REFERENCES

- A. American National Standards Institute (ANSI)
- B. National Electrical Code (NEC)
- C. Underwriters Laboratory (UL)

1.4 SUBMITTALS

- A. Provide a preliminary installation schedule to the Engineer 30 days before the start of work.

PART 2 PRODUCTS

2.1 POWER

- A. Use electrical components as listed and defined by the National Electrical Code (NEC).
- B. Supply conduit per Section 13553, junction boxes per Section 13554, and ground rods per Section 13554 and NEC 250.
- C. Use 4-inch schedule 40 galvanized pole for solar power only.

2.2 RPU TOWER FOUNDATION AND SERVICE PAD

- A. Compact according to Section 02324
- B. Use Class AA (AE) concrete per Section 03055
- C. Use 6-6-10-10 welded wire mesh per Section 03211.

2.3 TOWER GROUNDING SYSTEM

- A. Wire: State-Furnished 32 strand, #210 weight, $\frac{7}{16}$ -inch tinned copper ground cable. Refer to AT Series Standard Drawings and NEC 250.
- B. Ground Rod: Furnish $\frac{5}{8}$ -inch diameter 8-foot copper clad. Refer to AT Series Standard Drawings, NEC 250, and ANSI/UL 467.

2.4 ENVIRONMENTAL SENSORS, REMOTE PROCESSING UNIT (RPU), COMMUNICATION EQUIPMENT, AND RWIS TOWER

- A. State-Furnished.

2.5 FENCE AND GATE

- A. Furnish 7-foot high Type IV chain-link fence, with barbed wire and arm, and gate. Refer to FG Series Standard Drawings, AT Series Standard Drawings, and Section 02821.

PART 3 EXECUTION

3.1 GENERAL

- A. Conform to the requirements of the National Electrical Code (NEC).
- B. Obtain Engineer approval for tower site location and pavement sensor placement before construction.
- C. Notify the Engineer seven calendar days before desired pick-up of State-Furnished materials.
- D. Pick up State-Furnished materials at the following location:

Utah Department of Transportation
Traffic Operations Center (TOC)
2060 South 2760 West
Salt Lake City, Utah 84104-4592

- E. Install conduit per Section 13553, junction boxes per Section 13554, and ground rods per Section 13554 and NEC 250.
- F. Install all State-Furnished materials per manufacturers' instructions.

3.2 RPU TOWER FOUNDATION AND SERVICE PAD

- A. Install concrete foundation and service pad. Refer to Sections 03055 and 03211.
- B. Provide all necessary grading for a flat and level site. Refer to Section 02330 if necessary.

- C. Finish all surface concrete with Ordinary Surface Finish per Section 03310.
- D. RPU and tower installed by the Department.

3.3 TOWER GROUNDING SYSTEM

- A. Wire (Installed by the Department): Install one ground cable for each tower leg. Clamp wire to the outside ground rod (10 feet from tower leg) and run to the inside ground rod (3 feet from tower leg). Clamp wire to the inside ground rod. **DO NOT cut the wire.** Run the wire across the top of the concrete pad (Refer to Section 02776) to the corner of the RWIS tower. Attach grounding wire to the tower.
- B. Ground Rod: Install as per AT Series Standard Drawings.

3.4 ENVIRONMENTAL SENSORS

- A. Installed by the Department.

3.5 REMOTE PROCESSING UNIT (RPU)

- A. Installed by the Department.

3.6 COMMUNICATION EQUIPMENT

- A. Installed by the Department.

3.7 RWIS TOWER

- A. Install tower base only. Refer to AT Series Standard Drawings.

3.8 FENCE AND GATE

- A. Install chain link fence and gate per Section 02821.
- B. Install 7-foot high Type IV fence, with barbed wire and arm, and gates per AT Series Standard Drawings and FG Series Standard Drawings.

END OF SECTION

**Supplemental Specification
2005 Standard Specification Book**

SECTION 13594

FIBER OPTIC COMMUNICATION

Delete Section 13594 and replace with the following:

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Materials and procedures for installing and testing fiber optic communication systems.

1.2 RELATED SECTIONS

- A. Section 13551: General ATMS Requirements
- B. Section 13553: ATMS Conduit
- C. Section 13554: Polymer Concrete Junction Box
- D. Section 13555: ATMS Cabinet

1.3 REFERENCES

- A. Electronic Industries Association (EIA) and Telecommunications Industry Association (TIA) Specifications
- B. National Electrical Code (NEC)
- C. Telcordia Guidance
- D. Underwriters Laboratory (UL)
- E. USDA Rural Electrification Administration (REA) Specifications

1.4 DEFINITIONS

- A. OTDR: Optical Time Domain Reflectometer
- B. OSP: Outside Plant
- C. SMF: Single-mode fiber
- D. Backbone: 72 SMF strands or greater
- E. Distribution: 24 SMF to 71 SMF strands
- F. Drop: 6 SMF to 23 SMF strands

1.5 SUBMITTALS

- A. Provide all submittals in accordance with Section 13551.
- B. Provide evidence of training and experience for all fiber optic staff, including but not limited to installation technician, splice technicians and test technicians.
 - 1. Include in the file for each technician the following:
 - a. Resume listing relevant education and experience
 - b. Certificate of completion for the fiber optic training course.
- C. For approval:
 - 1. A detailed construction and installation procedure covering all aspects for the fiber optic cable installation on this project.
 - 2. All materials for the fiber optic cable installation on this project.
 - 3. Fiber labeling setup.
- D. Submit OTDR test results to the Department in a neatly bound and printed format for acceptance. Include the current calibration certificate for the OTDR being used at the front of the documentation. Electronic submittal to Engineer on floppy disk or CD is also required. All Electronic files will be compatible with Siecor OTDR 383PCW Version 1.21 or higher.
- E. Submit Power Meter/Light Source Test results to the Department for acceptance. Obtain the test form from the Department Fiber Representative.

PART 2 PRODUCTS

2.1 GENERAL

- A. All materials are UL listed.
- B. Provide all incidental materials including but not limited to fiber optic jumpers, cable ties, labels, data cables, and connectors.
- C. All materials meet Fluid Penetration Test standards (TIA/EIA-455-82B).

2.2 FIBER OPTIC CABLE

- A. Fiber must be approved by the USDA Rural Electrification Administration (PE-90).
- B. The fiber optic cable is an Outside Plant (OSP) type, armored dielectric loose tube, single-mode cable.
- C. Include the manufacturer's test documentation. This documentation indicates the attenuation of each cable fiber in dB/km, measured at 1310 nm and 1550 nm for single-mode.
- D. Outside Plant (OSP) Single-mode.
 - 1. Fiber Optic Glass: Corning SMF-28E or approved equal.
 - 2. Gel-Free Fiber Optic Cable: Corning ALTOS Lite or approved equal.
- E. Fiber optic cable must comply with Telcordia GR20-CORE and TIA/EIA-4720000-A.
- F. Outer jacket labeling:
 - 1. The date of manufacture and the manufacturer's name.
 - 2. A numerical sequence, at intervals no greater than 10 ft, to determine the length of cable and amount of cable remaining on the reel.
 - 3. "UDOT Fiber Optic Cable" at an interval of no greater than 10 ft.
 - 4. Height of the markings is $\frac{1}{8}$ inch nominal.

2.3 FIBER OPTIC CONNECTORS

- A. With the following characteristics and as specified in the contract:
 - 1. LC – Connectors (Standard)
 - a. Factory installed prepolished or field installed camlock LC connectors.
 - b. Ceramic ferrules.
 - c. Maximum insertion loss: 0.30 dB.
 - d. Connector back reflection: greater than 35 dB.
 - 2. ST – Connectors (to be used only where approved)
 - a. Factory installed or field installed ST or ST compatible connectors.
 - b. Ceramic ferrules and metallic connector bodies.
 - c. Maximum insertion loss: 0.30 dB.
 - d. Connector back reflection: greater than 35 dB.
- B. Clean all connectors with alcohol wipes and a compressed cleaning gas.
- C. Furnish and install new fan-out kits to replace any existing fan-out kits that must be severed to make fiber terminations.

2.4 TYPE A AND B FIBER OPTIC CABLE SPLICE ENCLOSURE

- A. Provide splice enclosures with the following minimum characteristics:
 - 1. Comply with Telcordia GR-771
 - 2. Corrosion resistant shell
 - 3. Allow re-entry without replacing the cable seals
 - 4. One 3-section end plate with 6 pre-molded cable entry ports
 - 5. One blank end plate
 - 6. Hinged splice trays to provide easy access to splices on other trays
 - 7. Strength member tie-off
 - 8. Mechanism to resist cable pull-out
 - 9. All required accessories to complete the splice
- B. Type A:
 - 1. Accommodates up to 288 splices
 - 2. Contains 2 or more 36-count splice trays
- C. Type B: For locations with up to 48 splices.
 - 1. Accommodates up to 48 splices
 - 2. Contains 2 or more 12-count splice trays

2.5 SPLICE ENCLOSURE FIBER DETAILS

- A. Provide 3 ft of buffer tube slack from end plate.
- B. Provide label for each buffer tube located 1 inch from the splice tray. Description on label will identify as to which fiber cable and direction cable is coming from.
- C. Provide 3 to 4 ft of fiber optic strands, outside of buffer tube, from each cable before splicing.

PART 3 EXECUTION

3.1 INSTALLERS

- A. Complete a three-day course on the installation, splicing, and testing of fiber optic cable.
 - 1. Course: conducted by the supplier of the fiber optic product or established education provider.
 - 2. In house and on the job training are not acceptable.
- B. Demonstrate two years total and one year continuous work experience with the splicing, termination, and testing of fiber optic cable.
- C. Perform all work with qualified staff.

3.2 FIBER OPTIC CABLE INSTALLATION REQUIREMENTS

- A. Do not perform fiber splices that are not shown in approved splice details without prior written authorization from UDOT ITS Fiber Division located at the UDOT Traffic Operation Center, 2060 S., 2760 W., Salt Lake City.
- B. Splice all drop cables to the main run of fiber with a mid span entry to the cable, unless described differently in the contract.
- C. Notify the Engineer five business days in advance of fiber optic cable installation into any existing conduit, ATMS site, or building facility.
- D. The Engineer may initiate special inspection procedures to verify the condition of existing communications facilities. Observe inspections as desired.

- E. Perform all work in facilities on conduits, junction boxes, cabinets, and buildings containing the Department's existing equipment only in the presence of the Department's representative.
 - 1. Refer to Section 13553 for conduits
 - 2. Refer to Section 13554 for junction boxes.
 - 3. Refer to Section 13555 for cabinets.
- F. Restore Contractor damaged facilities within 48 hours.
- G. Lubricate cable with a lubricant designed for fiber optic cable installation.
- H. Use shear pins or other failsafe means to prevent exceeding the maximum cable pulling tension specified by the cable manufacturer.
- I. Maintain the following minimum bend radii:
 - 1. 20 times Cable Diameter during installation.
 - 2. 10 times Cable Diameter installed.
- J. Maintain the following minimum slack requirements:
 - 1. Splice Points: 35 ft from installed splice case to conduit on all cables
 - 2. All Other Junction Boxes: 15 ft.
 - 3. Cabinets: 15 ft.
- K. Replace any fiber optic cable segment not meeting the requirements of the specifications in its entirety between full splice points shown in the contract.

3.3 FIBER OPTIC CABLE PREPARATION

- A. Solvent requirements:
 - 1. Must not remove any color from individual fibers (Refer to TIA/EIA-598-A) or buffer tubes.
 - 2. Not harmful to the polyethylene cable jacket.

3.4 ENTRY AND REENTRY OF FIBER OPTIC SPLICE ENCLOSURES

- A. Perform all work in an environmentally controlled atmosphere. Acceptable environments to work on splice enclosures include office type environments in buildings, splice trailers, and splicing tents with floors. All splicing, testing, connecting, or opening of fiber ends must not occur in locations with freezing temperatures, rain, snow, or wind-blown dust.

3.5 FUSION SPLICING

- A. For all fiber splicing, use fusion splice method.

- B. Perform fusion splices as follows:
 - 1. Use equipment with automatic fiber alignment and automatic light injection with detection devices or profile alignment algorithms to estimate splice losses.
 - 2. Provide splice enclosure as a protection for all splices and stripped cable.
 - 3. House all splices in splice trays or organizers.
 - 4. Use glass capillaries, heat shrink tubing, or silicone sealant to provide additional protection and strain relief.
 - 5. Comply with maximum splice loss allowance of 0.05 dB.
- C. Install new splice enclosure end plates per manufacturer's recommendations at each location where there is a new fusion splice in an existing splice enclosure.

3.6 CABLE LABELING REQUIREMENTS

- A. Label all fiber optic cables in every accessible location with a high quality permanent label, indicating the street name or location and type of circuit (e.g., drop cable, distribution, and backbone-96 count).
- B. Use Panduit MP-150-C or equivalent.

3.7 ACCEPTANCE TESTING

- A. Contact the Engineer five business days before performing all acceptance testing (Post Termination and Splicing OTDR and Power Meter).
- B. Perform all fiber optic testing with an OTDR capable of producing output files compatible with the Siecor OTDR 383PCW Version 1.21 or higher.
- C. Repair any damaged fiber strands using fusion splicing methods and repeat all tests described below.
- D. OTDR Testing Requirements:
 - 1. After completing the required work, test every fiber strand passing through any open splice tray.
 - 2. Conduct all traces with a pigtail or fiber box between the OTDR and the fiber under test. Use pigtail of sufficient length as to show the connector, or the start of the strand under test.
 - 3. Do not exceed launch transition of 0.6 dB.
 - 4. Conduct all traces at both 1310 nm and 1550 nm.
 - 5. Unless otherwise noted, uni-directional traces are acceptable.

6. Provide traces with the following information:
 - a. Horizontal Axis: Distance in Feet and Kilometers.
 - b. Vertical Axis: Attenuation scale in dB.
 - c. Traces showing attenuation versus distance.
 - d. Cursors positioned at cable ends.
 7. Tabulate for each trace: method, fiber type, wavelength, pulse width, refractive index, range, search threshold, reflection threshold, end threshold, warning threshold, backscatter, jumper length, file date, file time, fiber ID, cable ID, OTDR location, far end location, operator initials.
 8. Provide an event table showing all events having more than 0.05 dB loss, containing event type, position from OTDR end, loss and reflectance.
 9. For cables less than 3300 ft (1 km) in length, the maximum total allowable attenuation is 1.0 dB.
 10. Identify fibers by strand number.
 11. Submit results in printed form on 8 ½-inch x 11-inch paper in a suitable binder organized by cable and strand number.
 12. A cover sheet is required for each binder indicating which cable(s) were tested, the OTDR users name, the reviewers name, the type of test performed and the date(s) of the test.
 13. Cover sheets for final test results bearing the reviewers signature, the date, and a statement indicating that the installation complies with the requirements of this section is required.
 14. The Contractor's employee who has reviewed the traces is required to sign or initial them. A check mark is required on all traces that satisfy the requirements identified herein. For intermediate test results, flag any discrepancies that may exist with a short description of the proposed corrective action (e.g. resplice).
 15. Submit to the Engineer on 3½-inch floppy disk or CD electronic media with a printed index.
- E. Post Installation / Pre-Splicing Test:
1. Fibers Tested: Normally, one strand per buffer tube. Test every strand when evidence of physical damage, excessive pulling tension, and kinks exist, or when any damaged strand is found.
 2. Light Frequency: 1310 nm and 1550 nm.
 3. Direction: Uni-directional.
 4. Location of test: One field location for each cable installed.
 5. Test after installing cable in duct but before splicing.
 6. Tested by: Qualified Staff.
 7. Witnessed/Approved by: Department inspector may witness and must approve before splicing.

8. Acceptance Criteria:
 - a. Cable attenuation 0.4 dB/km at 1310 nm.
 - b. Cable attenuation 0.25 dB/km at 1550 nm.
 - c. Strand lengths are consistent.
 - d. Launch Transition < 0.6 dB.
 - e. No event > 0.10 dB.
 9. Trace available for one strand in every buffer tube in the cable.
- F. Post Termination and Splicing Test:
1. Test every strand in all cable segments including connectorized strands of drop cables.
 2. Light Frequency: 1310 nm and 1550 nm.
 3. Direction: Unidirectional.
 4. Location of test: Every field location required to obtain access to each cable segment.
 5. Test after terminating and splicing at all points described in the contract.
 6. Cable Tested by: Certified Staff.
 7. Department inspector witnesses and approves before final approval by the Engineer.
 8. Acceptance Criteria:
 - a. Cable attenuation 0.4 dB/km at 1310 nm excluding splices described in the contract or authorized by the Engineer.
 - b. Cable attenuation 0.25 dB/km at 1550 nm excluding splices described in the contract or authorized by the Engineer.
 - c. Strand lengths are consistent.
 - d. Launch Transition < 0.6 dB.
 - e. No event > 0.30 dB.
 - f. Maximum splice attenuation 0.05 dB per splice unless otherwise described in the contract.
 9. Trace available for each strand in all cable segments.
- G. Power Meter/Light Test:
1. Connect the light source to the connectorized fiber at the location identified on the Fiber Optic Light Source Power Meter Test Form provided by the Resident Engineer or Department Fiber Representative at the pre-construction meeting. Connect a power meter to the other end of the fiber at the location identified on the Test Form. Record the results and submit the completed form to the Engineer.
 2. Use the light frequencies of 1310 nm and 1550 nm, or as indicated in test forms.
 3. Perform the test bi-directional.
 4. Test every field location required to obtain access to each cable segment.
 5. Perform all testing using a qualified staff member.
 6. A Department inspector witnesses and approves the results before final approval by the Engineer.

7. Acceptance Criteria:
 - a. Cable attenuation as called for in test plans.
 - b. Test is available for each strand indicated in test plans. Otherwise, test will be available for each strand in each cable segment.

H. All work to conform to the NEC.

END OF SECTION

**Supplemental Specification
2005 Standard Specification Book**

SECTION 13595

ATMS INTEGRATION

Delete Section 13595 and replace with the following:

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Integration of all appropriate ATMS devices, including successful completion and documentation of all field operational tests.
- B. Install and connect all incidental equipment as required for a complete and operational system.
- C. Furnish all necessary test materials, cables, connectors to complete and test the integration of the ATMS device.

1.2 RELATED SECTIONS

- A. Section 13551: General ATMS Requirements

1.3 SUBMITTALS

- A. In accordance with Section 13551.
- B. Test report for the 30 Day ATMS Burn-In Test.

PART 2 PRODUCTS Not used

PART 3 EXECUTION

3.1 ACCEPTANCE TESTING

- A. Provide a Completion Notice per Section 13551 once Local Field Operations Tests have been successfully completed on all devices. Notify the Engineer in writing of readiness to begin integration.
- B. Integration requires the successful completion of a 30 Day ATMS Burn-In Test, consisting of the verification of valid data and control at the communications demarcation point for all devices. Obtain UDOT's newest version of the 30 Day ATMS Burn-in Test Report form from the UDOT Web site. Refer to <http://www.udot.utah.gov/index.php/m=c/tid=719>.
- C. Notify the Engineer in writing at least five working days before the proposed date that the Acceptance Tests will take place. Obtain UDOT's newest version of the ATMS Testing Pre-Notification form from the UDOT Web site. Refer to <http://www.udot.utah.gov/index.php/m=c/tid=719>. The Engineer must witness the Acceptance Tests or designate an individual or entity to witness the Acceptance Test on the Department's behalf.
- D. Once the Local Field Operations Test has been successfully completed on all sites, the Engineer may grant Partial Acceptance of the project. The 30 Day ATMS Burn-In period begins at this time. Begin the 30 Day ATMS Burn-In period for all ATMS devices of the same type on the same day.
- E. Operate the device, in coordination with Traffic Operations Center (TOC) staff, on a daily basis during the 30 Day ATMS Burn-In period noting the results on the 30 Day ATMS Burn-in test form. The Department TOC staff may help verify the daily equipment operation if at the time of testing, communications are consistently provided from the site to the TOC.
- F. Promptly remedy the defect in the event of a failure due to equipment or workmanship.
 - 1. Provide the Engineer with a Completion Notice.
 - 2. Restart (from day one) the 30 Day Burn-In period for that device.
 - 3. The Engineer may identify an independent third party to specify what defects (if any) must be addressed for the work to meet the specifications in the event of a second failure at the same device. If defects are identified, cover the costs required to remedy the defect.
 - 4. The Engineer may authorize others to complete the work at no additional cost to the Department if the Contractor fails to remedy any identified deficiencies in the work within the time required by the Engineer.

- G. Engineer grants Final Acceptance after the 30 Day Burn-In period is complete and all required documentation has been received.

END OF SECTION